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VOLUME 7, No. 7 JULY 1955

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Editorial Comment

Pakistan cotton

INAUGURATING the 12th General Meeting of the Pakistan Central Cotton Committee in Karachi recently, Pakistan's Minister for Agriculture, Mr. Ghyasuddin Pathan said that Pakistan's cotton crop, which stood at 1.07 million bales in 1947-48, had now increased by about 700,000 bales. Yield per acre, he said, had gone up from 141 lb. of lint per acre in 1947 to 193 lb. in 1953-54.

The Minister, however, went on to state that the average yield in Pakistan was still low compared to that of some of the advanced countries, and was capable of considerable improvement. He said that a vigorous research programme, embracing a wide scientific field, had been initiated and a number of technical personnel were being trained abroad in order to overcome the shortage of trained scientists in the fields of cotton research and technology.

Mr. Pathan stated that the number of cotton research stations in the country had increased from six in 1947-48 to 14 in the current year. Three fibre-testing laboratories were in the process of erection and equipping at Lyallpur and Mirpurkhas, in addition to an up-to-date and well-equipped Institute of Cotton Research and Technology, which was being established in Karachi. For this, most of the equipment was being generously provided by the Colombo Plan and the F.O.A. under their Technical Aid Programmes.

He went on to state that the research programme initiated by the Committee was now bearing fruit and that in addition to two improved varieties already released for general cultivation, a number of improved and high-yielding strains had been evolved which were at different stages of breeding and testing.

On the subject of the control of pests he said the Committee had already started a scheme to study the effects of various modern insecticides on the different cotton insects and as soon as the results of these investigations were available they would provide valuable information to counter the damage done by these insects.

Canadian price support

A MAJOR policy decision to ask the government to put into action a permanent price-support-formula programme has been approved by the Canadian Federation of Agriculture.

At its recent annual meeting, the Federation said major commodities should have a price support of between 65 to 85 % of their basic price. The basic price would be calculated from the average price of the product for the past ten years, the ten-year average index of wholesale farm prices, and the most recent index of farm costs, including the cost of living.

The period 1925-29 would be used as a base for the indexes of wholesale farm prices and farm costs.

The provision to let the price go anywhere from 65 to 85 % of the basic price would ' appear to leave the price support programme with the maximum of flexibility consistent with minimum protection of the farmers price, the C.F.A. said.

In outlining the price-support-formula provisions, the Federation gave several examples of what the rates would have been if the formula had been used in 1954; for wheat the basic price would have been $2.05, with the range of 65 to 85 % being $1.33 to $1.74 per bushel in terms of Canadian currency; for good steers the basic price would have been $23.06 per 100 lb., with the range of 65 to 85 % being $14.99 to $19.60; for butter the range would be from 45.6 cents a lb. to 59.7 cents; for cheese it would have been 23.2 cents a lb. to 30.3 cents.

Unyamwezi Development Corporation

AN inter-racial concern, the Unyamwezi Development Corporation, has recently been formed to open up the 150-square-mile Lyella Basin, in the Nzeka district, by using private European and Asian finance and technical skill to make possible African peasant settlement. At present in its initial stages, the project will if successful, be run on commercial lines. Provision has been made for Africans to acquire a share and an equity in the project and for the board of directors to have a membership of five Asians, four Africans and two Europeans.

The Lyella Basin, an ancient lake silt bed, has no permanent water supplies, and plans include provision for damming and conserving water from the heavy rains, which at present drains away, and using some for irrigating rice fields. Considerable capital has been invested in the trials undertaken during the past seven months; an access road and dam have been built, and trial fields cleared and planted with various crops including rice, cotton, maize, sorghum, sunflower and tobacco, under various conditions. A large-scale mechanical ploughing service is to be provided at cost to African farmers and the Corporation plans to own and develop a base estate to provide a model for the area.

The scheme is sponsored by an unofficial member of the Legislative Council. Amongst those who have already actively participated are a group of Asian industrialists, African chiefs representing the Native Authorities concerned, the District Commissioner, and Canadian Exploration (Tanganyika) Ltd., who are initially acting as managing agents. Assistance has also been given by the Overseas Food Corporation, the Agricultural Department and the Local Administration.

The Ceylon coconut-seed garden

A PROBLEM of the improvement of monocotyledonous tree crops is maintaining the purity of planting material; often seed which will breed true to type is not available and vegetative methods of propagation cannot be used. Coconuts are an example of a crop of this description and the provision of high-yielding nuts for planting, which will breed true to type, is a difficulty. As pointed out in an earlier article in WORLD CROPS, Ceylon has embarked upon a campaign of regeneration for its older coconut groves and this demands a continuous supply of reliable planting material. Hitherto the difficulty has partially been surmounted by using nuts collected from selected mother trees or blocks of palms known to be high-yielding. The method is, however, not very satisfactory, since it does not eliminate the factors of accidental cross-pollination of high-yielding mother palms by pollen from low-yielding trees, and the presence of many low-yielding palms among the best high-yielding blocks is another detrimental factor.

To overcome this the Coconut Research Institute of Ceylon has recently opened an isolated seed garden for coconuts in the heart of the Ambakelle forest reserve, comprised exclusively of high-yielding planting material derived by the artificial cross-pollination of selected palms, each yielding in excess of 100 nuts per annum. Natural crossing with pollen from inferior palms is obviated by having a wide belt of jungle surrounding the seed garden on all sides; this entails that cross-pollination will be limited to good trees in the garden itself.

It is anticipated that by using nuts derived from this garden for planting, the low-yielding trees, which are so common a feature on estates in Ceylon at present, can be gradually eliminated as planting proceeds and the yields of coconut plantations throughout Ceylon gradually raised. The scheme is a new one and so far as we are aware the seed garden is the only one of its kind in the world. If it succeeds it will certainly be followed by others in Ceylon and other parts of the world. The garden was officially opened by the Ceylon Minister for Agriculture and Food, the Hon. Mr. J. R. Jayawardene, on April 23. We wish the undertaking every success; its development will be watched with interest.

£80 million for Colonies

IN a Despatch to the Colonial Governments (Colonial Development and Welfare Act, 1955. Despatch dated April 26, 1955, from the Secretary of State for the Colonies to Colonial Governments. Cmd. Paper No. 9462, May 2, 1955) on the subject of the Colonial Development and Welfare Act, 1955, the Secretary of State for the Colonies, Mr. Alan Lennox-Boyd, states that the new Act provides an additional £80 million, which, with the £40 million unspent from the provision made under the Acts of 1945 and 1950, will give a total of nearly £120 million of Colonial Development and Welfare money for expenditure in the period 1955-60. This, continues the Despatch, represents a substantial increase in the amount of assistance to the Colonial territories over the next five years, since it will permit an average expenditure of £24 million a year as compared with the actual current rate of expenditure of some £16 million a year.

In determining the territorial allocations, the main consideration has been the relative financial needs of the various territories, taking into account such factors as the physical capacity of each territory to carry out development, additional recurring charges resulting from development schemes, and the finance which, by the use of all local and external resources, each Government can reasonably be expected to have at its disposal over the next five years.

The Secretary of State reiterates the emphasis on economic development underlined by his predecessor (Mr. Oliver Lyttelton, now Lord Chandos) in 1953, namely that, while not underestimating the importance of basic social improvements in Colonial territories, Colonial Governments will defeat their objects if they are burdened with recurrent charges on capital which does not earn a reward.

The Despatch points out that in all but a few territories, Colonial Development and Welfare funds form only one element in the total finances which can be made available for development. Taking the Colonial territories as a whole, local funds have, since 1945, provided more than half the total finance required for development. Governments will naturally continue to look first to their own financial resources, including the greatest possible use of their sterling assets held in London, and will need carefully to examine the possibilities of raising additional revenues for development. It is considered right that Colonial Governments should also make the maximum possible use of all external sources of loan finance available to them over the next five years.

An enclosure to the Despatch shows the allocation of funds, including the estimated unspent balance of previous allocations and the new allocation of £80 million under the Colonial Development and Welfare Act, 1955. At £4 million each, Research and Higher Education receive the highest central allocations (to be spent on development in all territories) under the 1955 Act. Together with the unspent balance of previous allocations this provides £7,976,000 and £6,853,000 respectively. A further £1½ million is provided for Higher Technical Education in all the territories, bringing the total available to £2,469,000. For Geodetic and Topographical Surveys and Geological Surveys, a further £2,750,000 is allocated, making a total of £4,571,000 available during the next five years.

Under the allocations to the Colonial territories, the Caribbean area receives £13,560,000, making a total of £18,179,000 available after taking into account the estimated unspent portion of previous allocations. Within this area British Guiana and Jamaica receive the highest allocations, £3 million each, bringing their total available funds to £4,144,000 and £4,229,000 respectively.

West African territories receive a new allocation of £14,480,000, making a total of £22,372,000 after including the unspent balance of previous allocations. By the far largest portion of this allocation is devoted to the Federal and Regional Governments of Nigeria. East African territories receive £10,960,000 under the 1955 Act and the total fund now available is £14,426,000. Within this group Kenya receives a new allocation of £5 million and Tanganyika £4 million bringing the total available to £6,317,000 and £4,805,000 respectively.

The Mediterranean group—Cyprus, Malta and Gibraltar—receive a new allocation of £1,250,000 which is almost the same as the unspent balance of previous allocations.

In the Far East, the Federation of Malaya receives a new allocation of £4 million, bringing the total amount available to £5,135,000.

Mail order tea cuttings

A SHORT but unusual paper in the latest *Journal of Horticultural Science* (**30,** 1955, 129) discusses the problem of keeping tea cuttings alive and viable when they have to be transported from one place to another, even by post. Now that the vegetative propagation of tea from internodal cuttings has become a routine practice in India, the ability of cuttings to withstand delay and packing is of considerable commercial significance. The cuttings, to be any use, must carry a single leaf. The usual practice on a plantation is to set the cuttings in a bed immediately after they have been severed from the main plant. Delay has generally proved fatal, enough desiccation occurring in a few hours to destroy viability.

At the Indian Tea Association's Tocklai Station in Assam, it has been proved by several years of testing that cuttings, which are first set in a propagation bed, can be later removed for transport with a much lesser risk of desiccation and viability loss. There is a period between the formation of visible callus and actual root emergence when cuttings seem able to resist desiccation, even under severe drying conditions. The average period required for pretreatment in a propagation bed is about five weeks. Cuttings can then be kept under drying conditions for as much as seven days. The presence of moist, powdered charcoal with the cuttings in their pack also helps to reduce the percentage of loss; this has been done for sending cuttings to England by air mail. However, the use of plastic materials for packing, *e.g.* alkathene, prevents loss of moisture and even the need to pack with moist charcoal has been made unnecessary where the journey is not above eight days' duration.

It should not be supposed that the percentage of successful 'takes' will be as high as for cuttings that are struck without significant delay. From 50 single-leaf internodal cuttings, about 25 good plants can be expected when the cuttings are immediately set out in a bed. From the same number of cuttings sent by post after having been in a bed for five weeks, about 12 good plants can be expected. This might not seem a high proportion from 50 cuttings, but before the pretreatment idea was developed 50 cuttings sent by mail would rarely have produced even one plant. Also, the basic standard of comparison is what happens when rooted tea plants are transported—a much more costly operation which involves a bigger loss per plant when viability is destroyed.

The desert locust

THE threat to the countries of the Middle East and Western Asia from the depredations of the desert locust continues to grow, notwithstanding the ever increasing magnitude of the efforts to arrest it. The main centre from which the present series of locust outbreaks may be regarded as originally deriving is the Arabian peninsula, where large-scale breeding, until recently practically uncontrolled, has always occurred in the little-known recesses of the desert region. Of late years the urgency of the problem and the need for controlling a pest, which threatens, not only a considerable part of Southern Asia but practically the whole of Northern Africa, has given rise to considerable efforts to deal with the present and future outbreaks. In addition to the Anti-Locust Research Centre in London, of which the director is Dr. B. P.

Uvarov, FAO has, within the past two years, set up a Desert Locust Control Committee which met in Rome last April.

At this meeting Dr. Uvarov reported that, in addition to the present serious situation in East and Central Arabia, where large-scale breeding has been encouraged by the heavy rains experienced there this year, large-scale breeding is also in progress in North West Africa from Libya to Morocco. The prospects so far as they can be foreseen, are that large-scale breeding which is continuing this spring, may provide a threat to Pakistan and India and increase the threat to Africa as far west as French Equatorial Africa and also British and French West Africa; these places are also threatened with invasion by swarms from North Africa.

The present situation, therefore, seems even more threatening than it was, for example, during the war years. To combat it, however, a very large international effort is being made. In the Arabian Peninsula nine governments have sent control teams into the affected region and another six governments have contributed supplies or funds in aid of the campaign. The Saudi Arabian Government itself has inaugurated a large campaign within its own borders involving the expenditure of over $250,000. Under the auspices of FAO an international control centre has been set up at Jeddah in Arabia and it is the present intention to continue to maintain it so long as the present plague lasts. It is to be hoped that the present efforts will ultimately be crowned with success and that it will eventually lead to permanently keeping in check a pest which has been a menace to man's food supplies since the remote ages of the past. Certainly the degree of co-operation, which has been brought about among various races in the effort to keep the desert locust in check, should be an augury for world peace provided the same spirit of co-operation can be extended to other spheres.

Expanded village-AID programme

ABOUT 770 village workers will have been trained, graduated and sent out to help the people in about 3,850 villages throughout Pakistan by the end of this year. This steady expansion of the Village-AID (Village Agricultural - Industrial - Development) Programme will be accelerated by a newly signed United States Technical Assistance project agreement announced recently. An additional 840 workers, to serve another 4,200 villages, will be in training by the end of this year in nine Village-AID Centres throughout the country, providing further striking evidence of the foundations for a truly mass programme of Village-AID.

Under the agreement the U.S.A. will contribute $816,000 to the Village-AID programme. The Government of Pakistan has allocated Rs. 4,734,000 ($1,434,000). The 1955 allocations thus represent a major milestone in the Village-AID programme, with the Pakistan Government moving ahead to assume the bulk of the expense for the programme. In its initial years since 1952 the programme has been financed, *inter alia*, through U.S. assistance and the Ford Foundations, the latter having contributed Rs. 4 million ($1.25 million). The new Point Four agreement provides:

1. $406,100 for 18 American technical advisers already in the field, plus four new additional technicians.
2. $30,000 for sending six Village-AID officials to the U.S.A. for specialised training. Nine officials sent earlier to the U.S.A. are already working on this programme.
3. $379,900 for essential supplies and equipment. This includes aids such as six special audio-visual vehicles to tour the Provinces, demonstration materials such as sprayers and dusters, transportation for village workers' use, and equipment for pure water to be installed in villages of the Village-AID development areas in East Pakistan.

The Government is establishing a new Village-AID Centre at Lyallpur, bringing the national total to nine. The other Centres are at Daulatpur, Gaibandha and Tejgaon in East Pakistan, at Lalamoosa in the Punjab, at Peshawar in the North-West Frontier Province, at Pishin near Quetta in Baluchistan, at Rahimyarkhan in Bahawalpur and at Sakrand in Sind. The Sakrand Centre is to be transferred to Tando Jam near Hyderabad.

Some of the major objectives of the Village-AID programme are increasing agricultural production, improving health conditions, developing cottage industry employment and raising the standards of village literacy. In agriculture, the rice crop yield has been notably increased by the introduction for the first time on a broad scale of the Japanese method of rice sowing. In this method rice seed is planted first in a seed bed with only the good seedlings later transplanted to make systematic use of all available land, rather than merely scattering the rice seed at random on the fields.

For the health programme 1,200 tubewells will be installed in East Pakistan to be a major safeguard against typhoid and cholera. In West Pakistan the possibilities for development of the cottage handloom industry are being surveyed.

Mass adult education, including the Laubach system, is being studied by the Government as a possible method for improving the educational standard of the villagers.

Agrarian Reform in West Bengal since Independence

T. C. ROY, M.SC., D.PHIL., A.I.A.R.I.

There can hardly be any doubt that the past seven years will be looked back upon as one of the most eventful periods in the history of agricultural development in West Bengal. Full of socio-economic problems and the unassailable liability of feeding the hungry mouths of the teeming millions under the administration of a newly-born national government, this period has been marked with vigorous and determined activity to achieve a definite but hazardous goal. It is too early yet to appraise fully the events and their resultant effects in the field of agricultural development, but it can be claimed with certainty that it has been possible to work courageously according to a plan for realisation of a cherished ideal.

This map of West Bengal shows the number of present and proposed research and training colleges that will cover the country. Scale, 1 in. : 75 miles

TO understand the progress made in the field of Bengali agriculture in the post-Independence period it is necessary to have a fair idea of a few basic factors that were at work from the very inception of West Bengal as a separate state.

Basic factors

In 1947, to begin with, West Bengal had a total area of about 29,370 sq. miles, which in 1950-51 extended to 30,689 sq. miles due to the mergence of the State of Cooch Behar. Of this total, in 1950-51, the total cropped area was 13.2 million acres and the net cropped area was 11.7 million acres. Agriculture in this area is mostly dependent upon rainfall. Although the total average precipitation in the State amounts roughly to 69.13 in. all over the year, the distribution is most uneven, with two-thirds of the total precipitation occurring during the monsoon season between June and September. But whereas there is a perpetual threat of inundation or unwanted water at the critical period of crop growth during the monsoon, the rest of the year is characterised by droughty conditions, which limit agricultural activities. Consequently the area cropped more than once was only 1.5 million acres or about 10% of the total cropped area. Area not available for cultivation was 3.2 million acres and that under forests was 1.7 million acres. Cultivable wastes, including current fallows, amounted to only 2.96 million acres, most of which were fragmented and sub-marginal lands. This,

Bumper harvest in freshly reclaimed area under Sonarpur-Arapanch Drainage Project, West Bengal

together with the fact that there was not even the minimum area necessary in the State under forest cover and for grazing of cattle, offered no further scope for large-scale reclamation of cultivable waste.

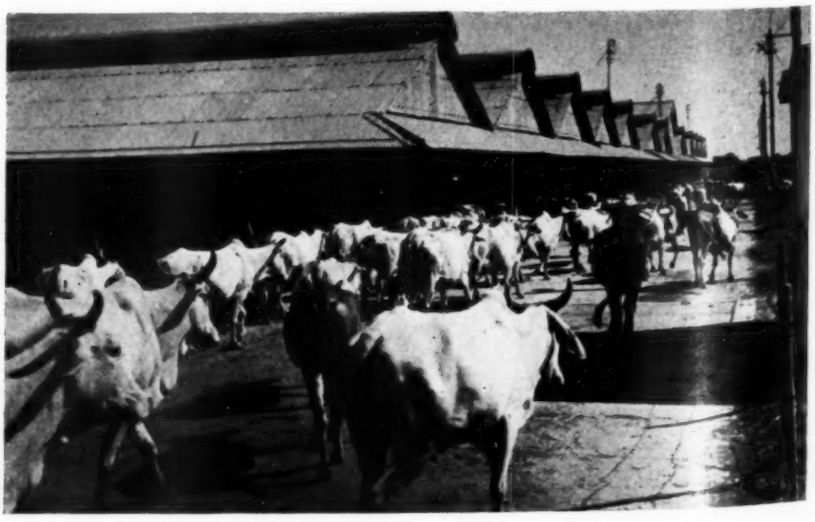
The census of 1951 recorded a population of 24.81 millions in the State with the density of population at 806 persons per sq. mile on an average. Of this number, 57.21% made their living from agriculture. The prevailing system of land tenure in the State under the permanent settlement was not congenial to agricultural development and had led to the development of many diverse unproductive interests. In the absence of suitable gainful employment in rural areas, the mounting pressure of the agricultural population on land was ever-increasing and this, together with the law of inheritance of landed property, was leading to continuous fragmentation of land, resulting in uneconomic holdings.

Land adjustment and reform

There was also the problem of land adjustment and of reforming the use of soil in order that future posterity may thrive well upon it. This demands a well-designed long-range cropping programme and new methods of tillage, especially when the land is very limited. The Bengali farmers are still accustomed to cultivate the same type of crops with primitive implements in small scattered holdings; this results in poor yields. Under dire economic stress a big portion of the farmers, especially the share croppers, were left with no desire to step up production, soil conservation, or for utilising the soil in a better way to enable them to meet the diverse needs of their family, or for effecting economic betterment. As a result the land has been subjected to continuous exhaustion and whatever crops the majority of cultivators were getting with least possible industry or investment on the land they were inadequate. They were thus indifferent and unmindful of adequate manuring or using improved seeds or implements which could have brought them the necessary succour. As a result theirs were far below the normal balanced dietary needs. The rural indebtedness under such circumstances in the State had quite obviously struck strong roots. Lack of fair price for most of the important agricultural products, want of marketing facilities in most of the rural areas and lack of quick and easy communication with big cities frequently proved to be the limiting factors for higher production. It is not surprising that agriculture in the State has been staggering under the disproportionate burden of population and leading to subsistence farming.

This trend in agriculture and land tenure does not fit into the pattern of what is believed to be desired for developing agriculture, and an easy and quick panacea is hard to achieve. Remembering these complexities of the agricultural problem in a truncated State that had the task of reorganising the entire working machinery, the developments that followed have to be judged.

It will appear from the previous brief sketch that West Bengal had to fight on her agricultural front with the limited land resources at her command. There was no possibility of economic improvement among agriculturists who farmed mostly on a subsistence level unless their average level of production was increased by using intensive methods, thus ensuring a surplus. It is a hard task indeed to dilate in detail on the various efforts made and the reactions of interacting factors ultimately reflecting on agricultural economy of the country within the narrow compass of this note. It has, therefore, been restricted to some of the broad and salient features of agricultural development.



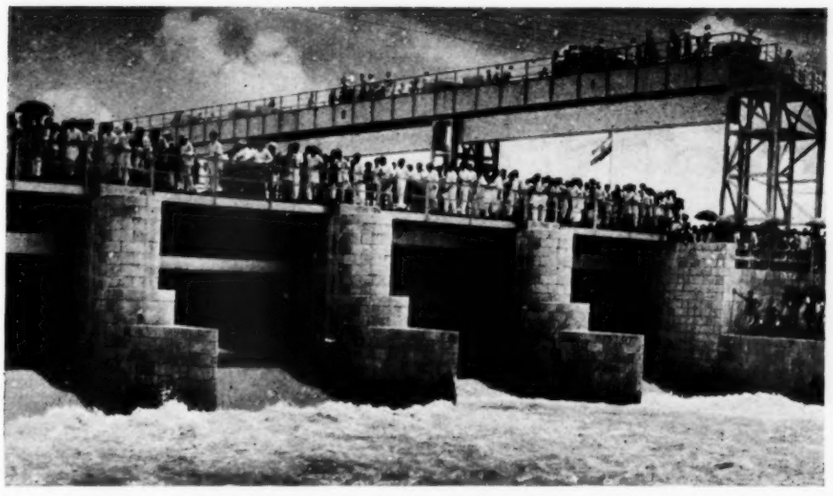
An improved herd of cattle on the Haringhata State Farm, West Bengal

Irrigation

No single factor is more important for intensive agriculture than an assured water supply. The new State of West Bengal started with only three old irrigation canals of some magnitude. According to the available figures, there was only about 13.1% of the total cropped area under irrigation. The solution of irrigation and drainage problems in the State called for an integrated policy based on scientific study of the peculiar condition of this deltaic State. The Government, while contemplating projects in order to provide irrigation facilities, put the greatest emphasis on the immediate need of increasing production of food grains. In view of these factors, both long- and short-term development programmes of irrigation have been formulated. The long-term programme includes 162 irrigation and drainage schemes estimated to cost Rs. 19.87 crore and to benefit about 1.19 million acres of land. But of these, 140 schemes were already completed up to August 1954 and are likely to benefit 0.46 million acres. The rest of the schemes will be nearing completion by 1956.

The 140 irrigation schemes which have been completed are inclusive of 106 minor irrigation and drainage schemes, nine major works and one multi-purpose river-valley project, *i.e.* the Mayurakshi Reservoir Project. The basic object of the Mayurakshi Project is to utilise the water for irrigating the Mayurakshi basin in West Bengal and for generation of power amounting to 4,000 kW. This project, when fully completed, is estimated to irrigate about 0.6 million acres in Kharif and about 0.12 million acres on an average in the *rabi* (spring) season. The Damodary Valley, which is yet another major project, embraces the two States of West Bengal and Behar and is one of the biggest in India.

The project was conveniently divided into two phases: the first phase comprises the construction of a thermal power station at Bokaro, four dams at Tilaiya, Konar, Maithon and Panchet Hill, with a hydro-electric station and the necessary number of sub-stations attached to each, and an irrigation barrage at Durgapur; the second phase comprises the construction of the remaining four dams together with hydro-electric stations.



Tilpara Barrage in Mayurakshi Project

Two of the major projects included in the first-phase programme have been completed, namely, the construction of the Tilaiya Dam and the Bokaro Thermal Station. Hand in hand with the above projects, small irrigation schemes, re-excavation of silted derelict irrigation channels, excavation of new small channels, construction of dams and sluices, and with each project costing Rs. 10,000 or less, have also been undertaken. One-third of the total cost of such projects is recovered from the beneficiaries either in cash or in kind as voluntary labour; the rest is subsidised by the Government. Up till now about 2,708 such projects, which have given immediate benefit for irrigation, have been completed in the State. Tank-improvement schemes and sale of irrigation pumping plants on an easy-instalment basis have also been given effect to afford irrigation facilities in addition.

Manures and fertilisers

Next in importance to irrigation is the factor of utilisation of manures and fertilisers by the farmers. Owing to their economic backwardness, the cultivators could hardly use any manures and fertilisers for better production excepting a few baskets of cow-dung and tank silt. The non-availability of fertilisers in villages of the remote interior was acute. Within the last few years, however, regular campaigns have been arranged to introduce the use of balanced fertilisers in adequate doses for better crop production. Arrangements have been made with the help of private traders to open a chain of depots and sub-depots in the interior within easy reach of most of the cultivators.

In the initial stages fertilisers were heavily subsidised by the Government and the subsidies were made available to them either in cash or on credit. They were repayable after the harvest, either in cash or in kind, *i.e.* by grains. Ultimately, however, the subsidies on some of the fertilisers have been gradually withdrawn, but these are still being distributed through numerous depots and sub-depots in rural areas under identical conditions. This has given an incentive to the use of fertilisers and, from a very insignificant figure, the yearly consumption has gone up to about 30,000 tons. Besides the consumption of fertilisers, the cultivators have made more liberal use of composts and sludge. Many municipalities (32) in the State have been preparing town compost and distributing about 20,000 tons each year. About 6,000 to 10,000 tons of sludge from Calcutta Sewerage are going to farmers' fields every year at a nominal charge of Rs. 6 per ton f.o.r. The use of green manuring and village compost are also rapidly gaining ground.

Reclamation of waste lands

The scope for land reclamation is very much limited in this State. But, due to the acute demand for agricultural land, particularly after the influx of refugees from East Pakistan, it has been necessary to reclaim some waste land for cultivation. A departmental

Transplanting of Aman paddy in West Bengal

fleet of tractors has been utilised for quick reclamation of some 26,000 acres of waste land during the past few years, particular attention being given to reclaim lands hitherto remaining swampy and unproductive. The Sonarpur-Arapanch Drainage Scheme undertaken by the Government to reclaim a swampy area of 57 sq. miles by means of four giant pumps draining out 375,000 gal. of water per minute is perhaps the biggest of its kind in Asia. An area of 27 sq. miles has already been dewatered in the first phase of the scheme and put under crops. The second phase of the work is in progress and in another year the entire area will be brought under productive cultivation. Tractors are also being made available on hire to cultivators for follow-up cultivation.

Attempts are also being made to bring the saline areas in the south under suitable salt-resistant paddy variety. New introduction of a flood-resistant variety and a drought - resistant variety of paddy has made it possible to produce two blades where none used to grow.

Distribution of seeds

Improved seeds, especially of paddy, wheat, potato, jute and sugar-cane, and grafts and seedlings of fruit trees are being distributed to cultivators either direct or through registered growers for replacement of the indigenous stocks. Besides the 10 regional State research farms, four seed multiplication farms have been started for bulk production of improved seeds. Side by side newly organised research sections are busy in selecting suitable varieties of seeds, mapping the soils of different districts, carrying out fertiliser trials, etc. Their recommendations are also being demonstrated in the cultivators' own holdings. There are about 1,000 such demonstration centres working in the entire State.

Plant protection scheme

It is estimated that at least 10% of the total agricultural produce in this State is lost due to ravages of pests and diseases in fields alone. In order to check this loss a plant protection service has been organised in the State for the provision of pesticides, equipment and service. This has already achieved a great popularity among the cultivators by their effective service. To begin with these were all given free of cost, but during the last two years only half the cost of the pesticides is being charged to the cultivators making routine measures. In case of epidemic or emergency, however, these are given free of any charge.

Attention is also being directed to the granting of agricultural loans to the growers. Crop loans, emergency loans and loans to big growers are being given to enterprising farmers either direct or through co-operatives.

Another activity is the development of marketing arrangements and other efforts to improve the general efficiency of the agricultural marketing. In order to keep the producers and the trade posted with the prevailing daily, weekly and monthly prices of agricultural and livestock commodities, regular communications and radio broadcasts are made. Prices of agricultural products prevailing at the terminal markets are being regularly disseminated to the different markets in producing areas. To improve their marketing facilities many primary producers are using co-operative marketing societies. Within the last two years there have been no fewer than 50 such societies which are working very well in the State and are already self-sufficient.

For the improvement of livestock, the State Government have undertaken the upgrading of indigenous cattle with improved bulls. Work in concentrated zones has been in progress where either improved bulls for service are maintained or artificial insemination centres have been opened. The unwanted scrub bulls in these areas are being systematically castrated.

Improved poultry birds and ducks or their eggs for hatching are being widely distributed to the farmers.

The veterinary services have been considerably expanded. The Diploma Course in Veterinary Science has been remodelled and upgraded to a full-fledged degree course to offer a better qualified service. The livestock breeding farm at Haringhata, which is the biggest in the State, has been the main source for supply of improved bulls and poultry birds. Elaborate arrangements have been made to establish a milk colony at this farm for meeting a large share of the demand for milk in Calcutta.

In order to effect an overall integrated development in selected rural areas over and above the normal administrative and developmental measures already under way in these areas under the various development schemes covered by the first five-year plan of West Bengal, 11 community develop-

ment blocks, covering about 2,101 mouzas (a mouza is roughly equivalent to a village), having a population of about 0.86 million, have been taken up since 1952. Besides integrated rural development, this scheme also envisages village township settlements. The main channels along which work has proceeded in the community development blocks are agriculture, irrigation, reclamation, health, sanitation, social education, communication, arts and crafts, and small industries.

Legislation

Last, but not the least, is the step taken by the Government for agrarian reforms. The West Bengal Estate Acquisition Bill, 1953, was introduced in the Legislative Assembly on May 7, 1953, and was referred to a Joint Select Committee of both Houses of the State Legislature. The Committee submitted its report on the Bill in October 1953. The Bill as reported by the Select Committee was passed by the State Legislature with certain modifications and it became law with the assent of the President; it was published on February 12, 1954. Under the provisions of the Act all rights in estates, including rights in subsoil, mines and minerals, huts, bazaars, forests, tolls and other Sariati interests, have been vested in the State free from all encumbrances other than the rights of *raiyats*, or non-agricultural tenants. The vesting has taken place from the first day of Baisakh of the Bengali year 1362, corresponding with April 15, 1955. With the abolition of zamindary the prevailing system of land tenure has given way to the interest of the tillers of the soil. By the end of 1956 the first five-year plan would come to an end and there is sufficient reason to believe that West Bengal agriculture, along with that of her other counterparts in India, would be placed on a much stronger footing. Underneath these great changes, however, there are continuing agricultural problems which require closer attention and nurture. Events are changing swiftly today and, to be able to keep pace with the changing world, agricultural practice has to be continually adjusted. Once the foundation is laid on firm grounds future developments will not be difficult to achieve.

Photos: Home (Publicity) Department, West Bengal.

Cotton Pests in Israel in 1954

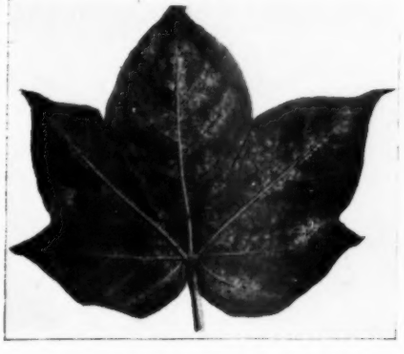
F. NITZANI and J. PALTI

After several years of experimentation in small plots, the summer of 1954 saw the first attempt to grow cotton in Israel on somewhat larger areas. A total of about 1,000 acres of cotton was grown under furrow and overhead irrigation, in the Jordan and Beisan valleys, the coastal plain and the northern Negeb Desert area. The variety grown was Acala; it was sown in April. Yields were satisfactory. A brief account of the pests and diseases encountered during this season is presented here.

Diseases

None of the root pathogens troublesome on other irrigated crops in Israel has so far been observed on cotton. In some cases cotton was grown in rotation with sugar beet, which was severely affected by *Sclerotium rolfsii* rot; in other instances the cotton bordered on tomato and tobacco fields with very high root nematode populations, but nowhere was the cotton seen to suffer from these troubles.

Contrary to some expectations, overhead irrigation did not induce outbreaks of leaf diseases.



Red spider mite injury on cotton leaf

Aphides, thrips and mites

Aphis gossypii appeared on cotyledons and stems within a few days of germination, but disappeared in May without necessitating control measures. Thrips caused some damage by infesting the growing points of seedlings and injuring the young leaves even before they unfurled. Red spider mites were fairly common throughout the summer, but could be controlled by sulphur before they caused marked injury.

Heliothis and prodenia

The larvae of a so far undetermined species of Heliothis appeared on flowers and bolls in May and were found in fair numbers throughout June-July. Damage was slight, largely owing to the continued control operations directed against the spiny bollworm. Not a single specimen of Prodenia was found in the cotton fields in 1954. This is most remarkable in view of the fact that adjoining fields of groundnuts and lucerne were severely defoliated by this pest, which caused exceptionally heavy damage. The absence of Prodenia from the cotton fields further stands in sharp contrast to the reports of large infestations received almost every year from Egypt.

Spiny bollworm

The larvae of the spiny bollworm (*Earias* sp.) again proved themselves in 1954 to be the most formidable adversary of the cotton crop in Israel. Appearing all over the country in late May, the larvae remained limited in number until July. Thereafter they were so numerous that up to 100% infestation of squares, flowers and bolls was observed on unsprayed fields. In autumn similar infestations were observed on fields of ochra (*Hibiscus esculentus*).

To meet the threat of the spiny bollworm practically all cotton fields were sprayed with an emulsion concentrate of endrin, containing 18.5% of active material. Of this material, 1,000-1,200 c.c. was generally applied in 100 l. of water per acre, seven to nine applications being made at 14/18-day intervals from early June until early October.

This treatment was very successful in controlling the pest and the percentage of infected bolls did not exceed 5-10% in any of the fields regularly sprayed.

Acknowledgment

The authors wish to express their gratitude to Dr. E. Rivnay and his assistant, Miss S. Yatom, to whom the cotton pests collected were submitted for identification.

Land Amelioration and Full-Employment Policy in Holland

DR. IR. F. DE SOET

The Dutch Government has been concerned for some time in making sufficient work available for the people of Holland, particularly the seasonal workers. Dr. de Soet, in his recently published book,[1] has suggested a solution to this problem and recommended that, in periods of unemployment, seasonal workers should be diverted to land reclamation and improvement schemes.

OWING to the growth of the population, the dependency on exports and the consequent vulnerability of the economy, the question of employment in Holland is a precarious one. Consequently, part of the active population is occasionally afflicted with unemployment caused by an unfavourable economic situation and, apart from that, lasting changes in the structural components of economic life in certain areas are sometimes the cause of regional surpluses of manpower to a more or less considerable extent. There are several other causes of unemployment, but, within the scope of this article, it may suffice only to mention seasonal unemployment, which prevails mainly in the agricultural sector as a consequence of the small demand for labour during the winter months as compared with the peaks of the demand for labour in spring and autumn.

Full employment

In principle the Government aims at removing all kinds of unemployment in so far as this is compatible with the needs of agriculture, industry and services for a certain labour reserve, and providing that full employment does not give rise to unjustified movements in the wage level. In its employment policy the Government has the disposal of a store of means in the field of economic policy, structural policy and employment-market policy. One of these resources is to grant subsidies for works that otherwise would remain undone.

The execution of these works is the final resort applied by the Government. First the Government tries to adjust the level of employment to the supply of labour by applying more universal means (*e.g.* fiscal policy or industrialisation). These universal methods, however, can never lead to full employment for all workers. In certain areas or occupational groups there will always be some workers for whom the above measures are ineffective. So employment has to be adjusted by means of these extra works when other means fail to be effective.

Thus by additional works the Government creates locally and temporarily an extra employment market in order to provide work for those workers who, for some reason or other, have not been able to find employment in a normal way. These works are called ' additional works ', which are executed on behalf of, or subsidised by, the Government.

Limitations

It will be understood that economic reasons force the Government to limit these works to certain fields, for the Government should never compete with private enterprise, as in this way the combating of unemployment in one district would give rise to new unemployment elsewhere. Nor are works, which would have been taken in hand without this subsidy within a period coinciding with the period in question, to be subsidised. Thus, generally, the only works that can be considered for execution are those which would not have been taken in hand but for the financial aid of the Government, either owing to a lack of funds, a lack of confidence in the future, or on account of the object being unable to bear the cost of depreciation and interest. The first two categories mainly comprise

Lowering of high, desiccated, arable land. Only by execution of manual power is it possible to build up the soil profile carefully and to allow for good water management

civil engineering works which, through Government aid, can be executed at an earlier date. The latter category mainly comprises the amelioration of agricultural land and horticultural and silvicultural soil.

Not all projects in the field of land amelioration are unremunerative. This largely depends on the possibility of making use of mechanical appliances instead of manual power. Generally, however, it may be said that the cost involved in land amelioration and reclamation still able to be undertaken in Holland is a multiple of the gain in the increased value of the land for the entrepreneur. Consequently, for all these works the Government has to bridge the gap between the total cost and the remuneration by means of a subsidy. The Government is prepared to do this because of the consequent increased production or decreased costs of production in agriculture, and because of its employment policy.

It is difficult to draw the dividing line between the projects of land amelioration suitable for normal employment and those which are to be reserved for the combating of unemployment.

State expenditure

Within the framework of the economic and full-employment objectives it will be understood that it is of importance that the total funds available for investment should be distributed over the country in such a way as to attain a justifiable distribution of the nation's prosperity.

To this end a system of calculation has been worked out in theory, according to which the social assets of investments in all fields of economy—both in the period of investment and in the productive period—are set against the social liabilities. From this follows the social yield of interest of a certain investment for a certain period, so that a standard of comparison is obtained for other investments calculated in the same way. Then it might be stipulated that only projects yielding a return of, for example, less than 4% are to be executed within the framework of additional employment. In practice this method of calculation has not yet proved to be workable, as, apart from all kinds of measurable influences which every investment is bound to have on the economic system, there are also all kinds of imponderables exercising their influence. Certain improvements in the field of land amelioration, *e.g.* re-allotment of land or drainage works, may put an end to the isolation of a certain district, may give rise to such a spiritual elevation of the population that the cost of the initial improvement of production is negligible compared with the practical results for the nation as a whole.

Raising low-lying waste ground with soil from higher land

Land re-allotment

In practice this problem is often solved in such a way that re-allotment of land, large drainage works and the reclamation of land are subsidised as normal works. The minor projects of land amelioration are reserved for additional employment.

In principle all these unremunerative works are to be considered for subsidies should the full-employment policy so demand. For economic reasons the works are chosen in such a way that those works that have the most favourable relation between the total cost and useful return or profit are the first to be considered for execution. This choice is also determined by the location of the object and by the number and nature of the unemployed workers to be placed. Consequently, it may occur in a district with a high percentage of unemployment that works which cost, for instance, 10 times as much as the measurable profits are carried out in order to realise full employment.

Social-economic policy

Apart from their technical functions, the works mentioned above thus fulfil the following functions in the social-economic policy: adjustment of employment, adjustment of the economical situation, binding of the labour reserve and testing the willingness to work of the unemployed part of the active population.

It is not relevant here to deal exhaustively with these different functions and their related problems in the fields of cyclical economic policy and labour market policy.

It will be understood, however, that, from the point of view of organisation, it is exceedingly difficult to co-ordinate the functions of these additional works.

This has been solved in practice by establishing a co-ordinating body for the employment-market policy, which, apart from including sections in the field of placement work, the training and retraining of workers and migration, also includes a section dealing with the disposal of the funds required for creating this additional labour market. It also directs these funds, according to the requirements of the labour market, either to the agricultural or to the civil engineering sections of the ministries concerned. These sections in their turn attend to the pre-

New land with parcel ditches and country roads

paration, subsidising and execution of these works.

Thus the co-ordination of employment policy and agricultural policy described above has resulted in a satisfactory combination serving both the interests of agriculture and of the unemployed. For, on the one hand, the basis of farming is improved so that the competitive power of agriculture and its contribution towards national production is enlarged. On the other hand, thousands of persons who are unemployed during the winter and who are willing to work are enabled to work in agriculture during the winter. Apart from that, these projects also provide work for other unemployed workers who, after having been trained for the performing of ground-work, are able to find employment and thus, out of their depressing state of unemployment, are raised to useful members of the community.

[1] de Soet, F.: 'Aanvullende Werkgelegenheid' ('Additional Employment'), 1955 (Leiden, Holland: Stenfert Kroese Ltd.).

English Advisory Committee on Rural Land Use

During the past few years the functions of this Advisory Committee on Rural Land Use have gradually dwindled until now by mutual agreement it has been decided to wind it up. Accordingly, Prof. Dudley Stamp, C.B.E., the adviser to the Ministry of Agriculture and Fisheries on rural land use, and his fellow rural land use advisers on the Advisory Committee on Rural Land Use have tendered their resignations to the Minister.

Prof. Stamp was appointed in 1942 as adviser on rural land use and his fellow rural land use advisers were appointed in subsequent years. They originally served as rural land use officers with the duty of keeping in touch with local planning authorities and the appropriate regional officers of other departments so as to advise them on the agricultural and rural considerations to be taken into account in town and country planning. When the Agricultural Land Service was established in 1947, it took over the executive functions of the rural land use officers who became advisers and formed an Advisory Committee on Rural Land Use. With the increasing experience of the Agricultural Land Service in land use work the occasions on which it has been found necessary to consult the Advisory Committee on Rural Land Use have become far less frequent. In these circumstances, Prof. Stamp and his colleagues have tendered their resignations since they feel that they can now render greater service in an independent capacity. They have, however, assured the Minister that their advice, whether individually or collectively, will remain at his disposal.

The Minister of Agriculture has therefore decided that he cannot do otherwise than accept these resignations in the belief that in present circumstances Prof. Stamp and his colleagues can give greater help in an independent capacity to the work of preserving good agricultural land wherever possible from development, to which the Minister attaches the greatest importance. At the same time the Minister has thanked the members for the many years of valuable service in a voluntary capacity which they have so generously given to himself and his predecessors in office.

Science in the Tropics

For the second consecutive year a successful Seminar on Science in the Tropics has been held at the Institute of Commonwealth Studies; the Institute is a department of London University. During the nine sessions, at which members drawn from a wide field in the natural, social and economic sciences and Colonial administration took part, papers were presented on the subject of 'Science in Colonial Development,' covering such diverse subjects as administration, human nutrition, social anthropology, public health and soil science. These papers provoked lively discussion, but there emerged general agreement on the urgent necessity for the clear interpretation of scientific results to the administrator and, by team action, to the village peasant so that fundamental research might best be concentrated in the centres of ancient cultures. In the under-developed territories scientific work should be more closely applied to practice.

The idea of employing troupes of artists to present scientific techniques in easily assimilated and dramatic form was quoted by an Indian speaker.

The Seminar was held under the chairmanship of Dr. W. F. Jepson, who, with Professor Macdonald and Dr. Raeburn, were responsible for the discussion and leadership.

Shade or No Shade for Arabian Coffee

A. E. HAARER, F.L.S.

Throughout the world the question of shade for coffee has been the cause of controversy among coffee planters, and among the research or overall authorities who guide or control the various coffee industries. It is only in recent years that research has been able to simplify the problem and give guidance to those who plant coffee. Mr. Haarer lends some support for the theory for shading Arabian coffee, but, at the end of this article, we have printed a note, extracted from the Information Bulletin, Inter-American Institute of Agricultural Sciences, which advocates a no-shade theory for nursery seedlings, at least under the conditions that prevail at Turrialba, Costa Rica.

IT is well known that Arabian coffee originated in the shaded, forest-clad valleys of southern Ethiopia, where it is found fringing streams and in forest glades. It sprawls or grows into a tall and slender tree in its efforts to reach the light, and the more light it is given, up to a point, the heavier the bushes have appeared to yield. It is unfortunate that when cultivated coffee grows in full sunlight it often overbears its strength and afterwards suffers disastrously from exhaustion.

Research has shown that when the leaves are exposed to intense light the stomata or breathing pores close; hence assimilation and the manufacture of carbohydrates are seriously retarded. At low altitudes in East Africa the stomata of exposed leaves close on bright days as early as 9 a.m. and do not open again until late afternoon.

This accounts for much of the trouble. Intense light encourages overbearing and then makes it difficult for the plant to manufacture enough food to maintain itself and mature its fruit at the same time. This knowledge helps to prove that the Arabian coffee tree is one that prefers a subdued light or, in other words, a partial shade in those regions where the sunlight is intense. Of course, the effects would be far greater if every leaf of a tree were exposed at the same time. In fact, only a proportion of the leaves are exposed at any time, for the foliage creates shade for the lower branches or for the eastern side of the tree as the sun moves west. Even so, the proportion of leaves affected are enough to tip the balance unfavourably when a tree is bearing its crop.

For these reasons the general advice in East Africa is to give shade below 5,000 ft. and to grow coffee without shade above this altitude, except at the highest altitudes in special circumstances where shade is again necessary for another reason, *i.e.* to protect the coffee trees from the cold night air.

The reason why coffee does not require overhead shade in East Africa at the higher altitudes is because the rainfall is more evenly spread, there is more cloud and mist, and hence the light is not so intense. It is not, it seems, a question of air temperatures so much as light intensity, although shade at the lower altitudes does help to steady and lower the temperature of the air surrounding the coffee trees. This also is important, because Arabian coffee grows best in a temperate climate without frost.

The questions of soil moisture and soil temperatures have their part to play, more particularly subsoil moisture, but first it is necessary to return to shade density. The fact that coffee grows so well in several other parts of the world without shade is undoubtedly due to the environment as a whole; to a light intensity which is less, or to a heavier rainfall and cloudy weather during the cropping and growth periods, which help to annul the effects of the brighter light during the resting periods.

Shade density

Shade should never be dense and it does not seem to be necessary before a coffee tree begins to bear fruit, hence overhead shade can grow up with the coffee if it is planted at the same time. Except at planting time to prevent wilting, temporary shade should be dispensed with because several authorities have proved that competition for moisture during early growth is more harmful than exposure to sunshine. It is soil shade that is needed in the form of a mulch.

The shade trees should be of a kind that grow fast, have a long life, a feathery foliage and are easy to lop or prune. They should have a spreading growth, and they are best planted in lines across the path of the sun and so widely apart that their branches, when full grown, do not interlace. They are required to throw shadows across the field during the longer hours while the sun rises to its zenith and then declines in the afternoon.

Altitude is not a good guide, for an aspect facing the afternoon sunshine may require a little shade above the 5,000-ft. level, whereas a plantation at a lower level facing the rising sun may not need shade at all. Common sense must be brought to bear on the question when the reasons for requiring shade are known.

Shade can have an influence on flowering and yield. A light shade need not depress yields, but a little more shade will begin to have an effect. Flower initiation is not so plentiful, the coffee leaves grow larger and the internodes longer the more shade is used. Shade, therefore, can be a means

An unshaded high-altitude coffee plantation in Kenya. The soil between the coffee trees is mulched with grass and this is cut from every piece of land available on the outskirts of the coffee fields. An opportunity is given to apply fertilisers to the grass rather than to the coffee

of regulating the yield and, to a certain extent, the time of ripening. The pruning of shade trees should have almost as close and careful attention as the pruning of the coffee trees.

Pests, such as the berry borer and some species of leaf miner, are encouraged by too much shade and shade trees which are susceptible and act as hosts for mealy bugs and other pests which attack coffee should not be planted on an estate.

Since the shade trees must be of a kind, and planted at a distance apart so that they will not shade a coffee tree the whole time, a properly planted field, in actual fact, is open to a good deal of sunshine. On account of the constant movement of the sun and leaves overhead, and of the coffee leaves themselves disturbed by the movement of the air, no part of a leaf is shaded for very long or in sunshine for long enough to do harm.

Soil shade

It does happen, therefore, that the soil of a shaded plantation still needs extra shade, especially when the plantation is young, and in those regions where the rainfall is short and there is likely to be a moisture deficit in the subsoil. The shade tree may be of a kind that will drop ample litter, but if it does not then a grass mulch will be beneficial.

A mulch becomes imperative to obtain best yields and maintain the health of the trees whenever coffee can be grown without overhead shade. Even where the light is not too intense, the soil temperatures can rise too high during sunny days. A mulch keeps the soil cool, it preserves the microflora and conserves moisture. By its gradual decay it helps to maintain the fertility of the soil.

Species of overhead shade

Not only must a shade tree have all the attributes already mentioned, but it must be one which harmonises with the coffee in the environment where it is planted.

Some trees, even those of the legume family, appear to be antagonistic and harmful to coffee no matter what the environment happens to be, hence it is unwise merely to thin out a forest and leave indigenous trees for shade without exercising a choice and knowing beforehand what the result will be.

Moreover, having found a shade tree which harmonises with coffee in one country, it may well be found that the same tree will not harmonise with similar coffee elsewhere. A shade tree that prospers in one country will not always grow healthily in another.

It is this, of course, that has led to such confusion and has heaped fuel on the controversies of the past. It is generally a question of soil moisture and temperatures, principally the former.

The ideal shade tree has a rooting system and make-up which does not rob the coffee trees among which it grows of too much soil moisture or soil nutrients. Yet, in a region where the rainfall is short and the soil of a particular kind, it may well do so. Or the tree may not prosper.

When it has once been decided that overhead shade is necessary, it then becomes imperative to choose a tree which will succeed and agree with the coffee in the environment concerned. Guidance given by a local research station may not be sufficient if the plantation in question is sited on a different kind of soil, a different aspect of a mountain slope or where the conditions are not the same.

The author has seen unshaded unhealthy coffee at a low altitude in which odd specimens of the sausage tree, *Kigelia aethiopica*, and other in-

A shaded coffee plantation at low altitude in Kenya. Cordia holstii *is the tree often favoured. Note the open shade. The trees are trained to the single-stem method of pruning*

digenous trees stood. Against the trunks and beneath the dense shade of the heavily leaved sausage trees the coffee trees were healthy, but beneath the shade of the other trees the coffee was dead and dying.

Albizzia lebbeck appears to grow well as a shade tree in India, and the Lamtoro, *Leucaena glauca*, grows well in Indonesia, yet these trees are useless in most coffee regions of East Africa. They grow stunted with abundant seed pods and refuse to make good growth. Many of the *Erythrina* species do well in other parts of the world, whereas in East Africa they are attacked by grubs which bore into the young growths and prevent the trees attaining a suitable size.

The *Grevillea robusta* is not a suitable tree in shape and it competes too severely for the moisture supply in regions of short rainfall. Each tree must be decided upon according to its merits and behaviour in the differing environments of the coffee world. Many a planter has found that his coffee has done better without a particular kind of shade tree and he has assumed from this that his coffee did not require shade, whereas, had he tried another kind of tree or regulated his shade in the proper manner, he would have had a different tale to tell.

Doubtless in Brazil, despite the possibility that the light intensity may be less, the coffee there would be better with a light shade of the right kind, if only to aid in preventing the rapid deterioration of the soil and the premature ageing of the coffee trees. One would have thought they would give some protection from the frosts that do so much damage to coffee in that country.

Even though the guiding rules are known, there is still a lot to discover and argue about as to the best kind of shade for each locality. One is sorry for the planter who is opening up land in a new region where, on account of light intensity and warm temperatures, he is convinced that shade is necessary. One can only advise him to observe the effects on coffee of any local trees that appear suitable for shade.

Moreover, he may list the commonly used shade trees of the world and their attributes. Having decided to narrow his list he may then obtain all the information possible about the rainfall, temperatures and soils of the regions where these trees grow well and compare them with those of his own locality. In this manner may he improve his chances of success.

Generally speaking, where the rainfall is dependable and about 60-80 in. per annum, where temperatures do not rise much above 80° F. and the soil is fertile, well drained, but retentive of moisture, most of the best shade trees will thrive and grow well with coffee. It is where the rainfall is erratic and short, where temperatures are higher, and the soil easily dries out, that some of the best-known and more valuable shade trees are difficult to introduce among coffee. It is time that the requirements of each shade tree were listed along with its attributes or shortcomings.

Summary

It is described how light intensity is a factor ruling the necessity for shade; also how shade may ameliorate conditions and assist in maintaining fertility in regions where intense light is correlated with erratic rainfall and warm temperatures. The density of shade is discussed and how this may regulate crops. Several reasons are given for the controversy about shade which has persisted for many years, and how shade trees of different species may harmonise or not with coffee in different environments. The attributes of shade trees are mentioned and of how a species may prosper in one country but not in another. It is pointed out that there is insufficient data about the environmental requirements for most of the shade trees commonly used in the world.

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. . . but in Costa Rica

The cultivation of the coffee tree under shade is based, almost entirely, on empiric results rather than on scientific studies. The fact that the coffee plant, in its natural habitat, grows under shade is interpreted as a need for such a condition, for its better growth. There has not been any careful study to demonstrate this necessity or to explain why the coffee plant cannot grow under direct sunlight.

These ideas have been exposed in the introduction of a thesis presented by Armando Huerta, Bolivian student who entered the Inter-American Institute of Agricultural Sciences, Turrialba, Costa Rica, in 1952 and made studies of coffee physiology under Dr. Paulo de T. Alvim, Professor of Plant Physiology at the Institute. In his conclusions Huerta states that the physiological reaction of the young coffee plant to the stimulus of light was considered as one of a direct sunlight plant, in as much as photosynthesis and the 'proportion of relative growth' were gradually increased as light intensity increased. If the reaction was similar to that of a shade plant, the 'efficiency of assimilation' and the 'proportion of relative growth' should reach its maximum and then remain constant or decrease before the maximum light intensity is reached. The plants grown under direct sunlight had more dry weight, larger roots, more leaves and a larger number of stomata per leaf and per unit of leaf area.

The author considers that these results indicate that under the conditions at Turrialba the coffee nurseries should be maintained under direct sunlight, due regard being paid to the control of *Colletotrichum* and *Cercospora*, both of which seem to be intensified by sunlight.

Verona Agricultural Fair

Nearly 500,000 people visited the 57th International Agricultural Fair which ended recently. It was estimated that business worth 15,000 million lire was transacted at the Fair. There were 2,545 exhibitors at the Fair and they included 704 foreigners from 20 nations.

Cultivation of Pyrethrum on the Nilgiris—I

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Among the numerous vegetable chemical insecticides of the world, pyrethrum,* Chrysanthemum cinerarioefolium *(Compositae), occupies a unique place because of its cheapness and its wide applicability in its pure form and in admixture with other insecticides. One of the most remarkable features of pyrethrum is its lightning action on insects and it is, therefore, invaluable in any campaign where a quick 'knock down' is essential.

PYRETHRUM (*Chrysanthemum cinerarioefolium*) is a glaucous perennial 18-24 in. high. To the casual observer, pyrethrum resembles the ordinary field daisy but the two are readily distinguishable. The stems are unbranched and slightly hairy. The leaves are petioled and finely cut. 'The dried flower heads are hemispherical and consist of a short rounded receptacle; a straw-coloured involucre composed of three rows of scales; a disc composed of numerous yellow flowers; a circle of white- or cream-coloured ray florets'.

Introduction of pyrethrum into India

The importance of pyrethrum, not only as a valuable anti-malarial insecticide but also as an easy means of keeping the soldiers free from ticks and body lice, was first realised during the Burma and Malayan campaigns of the last war. The loss of the Japanese source of supply and the ever increasing demand resulted in an all-out effort to find suitable places to grow pyrethrum for the Allies. Accordingly, experiments were started in several parts of India in 1942 with seeds obtained from Kenya, and after a number of small-scale trials, it was found that the Nilgiris, having almost the same climatic conditions as the Kenya highlands, offered an ideal place for the large-scale cultivation of pyrethrum. Large-scale plantations were begun in 1943, with an area of 1,400.88 acres. In the following year, an additional 466.64 acres were brought under pyrethrum making a total of 1,867.52 acres for the Nilgiris, and a separate pyrethrum division was formed in charge of a District Forest Officer.

Soil

Pyrethrum is comparatively indifferent to the type of soil in which it grows. But it requires good drainage, and soils with a clay pan or murram close to the surface would therefore be unsuitable. Very rich forest soils should be excluded, so as to avoid excessive vegetative growth (leaf) to the detriment of flower production. Diseases such as root-rot also seem to be more prevalent on such soils. Generally speaking, loams derived from volcanic rocks and capable of retaining the moisture content during the dry weather are the most suitable.

In the Nilgiris, pyrethrum has been raised in two types of soils, black loam in which the proportion of clay is slightly higher and a red loam, which is lateritic in origin, with a pH value varying from 3 to 5.1. The parent rock in both cases is a fine-grained gneiss. There has been no significant difference in the growth and production of flowers in the two types of soils. In South India, pyrethrum has been grown in virgin soils, although in Kenya, Dalmatia and Japan, virgin soils are strictly avoided on account of the very poor yield during the first year. Some cereal crop such as wheat, rye, barley, or oats is grown during the first year and this is followed by pyrethrum. This practice has given a significantly higher yield, particularly in Kenya.

Altitude

In the Nilgiris (latitude 8-11°N), pyrethrum grows well at elevations varying from 6,000 to 8,000 ft., the best growth being found above 7,000 ft. At lower elevations, although the plant grows, the production of flowers is comparatively low and it is not therefore economical to raise it on a large scale. Pyrethrum is highly sensitive to frost in its early stages and care should be taken to avoid frosty localities especially at elevations above 7,500 ft. Similarly, highly exposed areas are unsuitable as the cold winds in winter inhibit the growth of the bushes. However, if suitable wind belts are provided, the plants grow very well in such localities.

Rainfall

Pyrethrum can thrive even with a scanty rainfall but its monthly distribution is most important, because pyrethrum suffers very badly under prolonged drought. Generally speaking, a rainfall of 40-45 in., distributed over a period of 10-11 months in the year, is most desirable. In regions of heavy rainfall, the plants suffer very badly from 'damping-off' and what is more, the soil-wash will also be excessive, resulting in an appreciable fall in the yield.

Temperature

Temperature conditions as obtained at higher elevations in the Nilgiris seem to be very suitable for pyrethrum. In Ootacamund, which is situated at an elevation of 7,525 ft., the mean monthly temperatures show very slight variations from 54° F. in the months of December and January to 61° F. in the months of April and May.

Nursery technique

For a nursery site, it is desirable to select a well-drained gentle slope close to a perennial source of water. The ground is thoroughly dug up two or three times to remove all weeds and grasses. In the Nilgiris, Kikyu grass (*Pennisetum clandestinum*) is a very troublesome weed and particular care is taken to remove all bits of the roots, which if left will sprout up very rapidly. Standard nursery beds, 40 ft. long, 4 ft. wide and 3-4 in. high are then formed and 60-70 lb. of well-decomposed farm-yard manure is mixed thoroughly with the soil. The sides of the beds are protected with brush-wood. Paths one foot in width are left between the nursery beds for watering the beds, removing the weeds and other operations. After the beds are formed, they are watered for 3 or 4 days so as to remove any weeds that may be remaining in the soil, by allowing them to germinate. Pyrethrum seedlings are highly susceptible to weed competition and before the seeds are sown, all the weeds must be removed scrupulously.

Three to four ounces of seeds are sown per standard bed. Pretreatment of seeds with cold water for a period of 6-12 hours has given good results in the Nilgiris. After sowing, the seeds are covered with a thin layer of earth and pressed gently, and a layer of grass 2-3 in. thick laid directly on the soil. In areas, where white ant damage is serious, the grass cover is raised a few inches on trellis supported by forked sticks. Grass containing seeds should be strictly avoided as the seeds may germinate and choke the pyrethrum seedlings quickly. The beds should be watered daily from a very fine rose can. Removing the grass before watering is advisable and the grass may be replaced after watering is done. Germination starts in about 8 days and is complete in about 15-21 days. As soon as germination is more or less complete, the grass cover should be removed. The young seedlings are highly susceptible to 'damping-off' and if any sign of this is observed before the germination is complete, the grass cover should be removed and sun-light allowed to fall directly on the seedlings. The seeds are usually sown in the month of September or October and the seedlings transplanted in the following April or May. As soon as the seedlings have put forth four or five leaves, if the stand is too thick in the nursery beds, the seedlings should be pricked out carefully and transplanted in vacant beds kept ready for this purpose with a spacing of 3 in. × 3 in. This will not only prevent 'damping-off' in the beds but also produce seedlings of uniform size and good vigour. On an average, one standard bed of 40 ft. × 4 ft. will give 2,500 good seedlings.

A view across the 'Dawns,' Ootacamund, Nilgiris District, India

Splits versus seedlings

Pyrethrum is propagated either by seed or from splits from older plants. It cannot be stated definitely which one of the two methods is better. One significant advantage in planting splits is that they establish themselves much quicker, especially if the planting is followed by a spell of wet weather. If seedlings are used under such conditions they may be covered with soil and silt washed down from the slopes, and may have very little chance of establishing themselves. Moreover, splits have the advantage of coming into production earlier than seedlings, and of producing higher yields during the first year. Seedlings are, however, able to survive much better than splits in dry weather. The advantages of vegetative propagation by splits have not been properly evaluated.

Preparation of land

As pyrethrum is a plantation crop and stays in the ground for several years, it is desirable to clean the land thoroughly of all weeds, particularly grass, before planting is done. The land is therefore ploughed or forked two or three times and the clods are broken. It should, however, be remembered that the soil should not be broken down to a fine tilth, because during further operations in the field such as picking and weeding, the constant trampling of human feet may result in the soil being compacted into a hard mass. Sloping ground is well terraced, or graded contour trenches are formed at suitable intervals. In the Nilgiris, in addition to graded contour trenches, uncultivated grass belts 5-10 ft. wide are left alternating with cultivated strips which are 11-30 ft. in width to prevent any soil wash. The earth in the forked strips is formed into ridges 6 in. high and 2½ ft. apart after being allowed to weather for about two months. Seedlings are planted in the ridges formed.

Spacing

It cannot be stated definitely which spacing is the best as these vary in different countries. In the Nilgiris, experiments have been conducted as shown in Table 1.

TABLE I

(Spacing in feet)

(*a*)	2½	between	rows	and	2½	in	rows
(*b*)	2½	,,	,,	,,	2	,,	,,
(*c*)	2½	,,	,,	,,	1½	,,	,,
(*d*)	2½	,,	,,	,,	1	,,	,,
(*e*)	2	,,	,,	,,	2½	,,	,,
(*f*)	2	,,	,,	,,	2	,,	,,
(*g*)	2	,,	,,	,,	1½	,,	,,
(*h*)	2	,,	,,	,,	1	,,	,,
(*i*)	1½	,,	,,	,,	2½	,,	,,
(*j*)	1½	,,	,,	,,	2	,,	,,
(*k*)	1½	,,	,,	,,	1½	,,	,,
(*l*)	1½	,,	,,	,,	1	,,	,,

The data collected, when analysed statistically, have shown that treatment (*b*), *i.e.* 2½ ft. between rows and 2 ft. in rows, has given significantly the best results. However, in the older plantations started in 1943 and 1944, closer spacing of 1½ ft. between plants and 2-2½ ft. between rows was adopted. It has been also observed that plants grown too close together do not yield well, especially after the second year. From the experience gained in the Nilgiris during the last five years, it may be stated that an average bush grows to a circumference of about two feet and it is therefore advisable to plant seedlings at this distance from each other. The 2½-ft. width between the rows will not only reduce the nursery and planting costs appreciably but also enable easier weeding. In slopes and in places where the soil is highly erosive, it is advisable to plant seedlings closer together in the rows as this would form a continuous hedge and prevent soil wash. On the whole each area must be judged on its own merits and suitable spacing determined.

Time of planting

In the Nilgiris, as a result of numerous experiments conducted to determine the best time of planting, it has been found that April planting immediately after the pre-monsoon showers gives significantly the highest yield per acre. As a general rule, planting should begin when the ground is wet, and the weeds have been germinated and either removed or harrowed in. On sloping ground, the planting lines should follow the contours. The planting lines should be parallel to the top contour so that the short lines end in the lower contour. As soon as the first pre-monsoon showers are received between April and May, seedlings with at least three pairs of leaves are carefully lifted from the nursery beds and taken to the planting area in baskets. It is advisable to discard those seedlings showing swellings on the roots as such swellings are characteristic of eel worm attack. The discarded material should be either buried deep or burnt. Care should be taken to see that the root system suffers from the least possible damage. The planting holes must be dug deep enough to receive the whole root system without the roots being twisted upwards. After the roots have been inserted as straight as possible, the soil must be pressed firmly around them without leaving any air space. If the soil is too wet, it should not be pressed too hard as it would form a cake and harden in a dry spell and might lead to the death of the plants. In fact, in very wet weather, it is better to defer the planting for a few days. Deep planting should be avoided as it results in significantly lower yield. Experiments conducted in the Nilgiris have shown that it is advantageous to cut back newly planted pyrethrum when about three stalks have developed, because this encourages the seedlings to shoot forth with great vigour. The seedlings should establish themselves under normal climatic conditions in about a month's time. If gaps appear in the lines, they should be immediately filled up with either seedlings or splits.

Tending

Regular weedings are necessary for the reasons explained above. The common weeds found in the Nilgiris are *Eupatorium glandulosum*, *Helichrysum* spp., *Vernonia* spp., *Hypericum mysorensis*, *Eulex europeus* and *Cytisus scoparius*. The common grass, as already indicated, is Kikyu. Weeding is best done by hand pulling at regular intervals and before the plants flower.

Normally two weedings are done during the year of planting; the first weeding early in July and the second weeding after the South-West monsoon is over, *i.e.* by September-October. The weeds after being pulled out are heaped in the trenches between ridges so as to form a mulch. From the second year onwards it is necessary to do three weedings a year, the first weeding in July, the second in September-October, and the third in June. If found necessary, a fourth weeding may be done between February and March.

In the past, forking the soil between planting lines was done, as it was believed that the soil working would encourage the growth of the plants. Subsequent observations in the field and the reports from Kenya have, however, shown that the root system of pyrethrum should not in any way be disturbed if the plants are to grow satisfactorily. Soil working is therefore not recommended now. Weeding operations should also be done carefully to avoid damage to the root system.

Manuring

In Kenya it has been estimated that a record crop of 1,000 lb. of dry flowers per acre deprives the soil of only 17 lb. of nitrogen, 25.75 lb. of potash and 5.75 lb. of phosphoric acid. Experiments conducted in the Nilgiris have shown that pyrethrum does not readily respond to manuring. In Kenya application of small quantities of phosphates in and around the planting holes is reported to be giving very good results.

Picking

In the Nilgiris the bushes start flowering in about six to nine months after planting, depending on the pre-monsoon showers. If the planting is followed immediately by a dry spell of weather, the plants may take as much as nine months to flower, but if the weather is normal in April and May, and four or five good showers are obtained, flowering starts even after four months. The yield of flowers during the first year, as indicated above, is comparatively low and it may vary from 50-100 lb. of fresh flowers per acre. The yield is significantly more during the second year and the peak production is reached during the third and fourth years. Thereafter, it falls.

The keeping quality of pyrethrum flowers and the *pyrethrin* content depend entirely on the stage at which the flowers are picked. Immature flowers and over-mature and full-blown flowers contain less pyrethrin, and it is therefore absolutely necessary to pick the flowers at the correct stage, which is when the flowers have at least three to four rows of disc florets open. People engaged in this work very soon learn to recognise the correct stage at which the flowers are to be picked. From the second year onwards picking

is done at the interval of seven days in the Nilgiris. In Kenya the flowers are picked at intervals of 10-14 days, in Dalmatia once a week, and in Japan at intervals of 14-18 days.

The flower heads are picked from the stalks, using the thumb and index finger, with a gentle jerk without causing any injury to the plants. Although it is a skilled operation, the boys and girls who are engaged in this work soon learn the technique, and they are able to do the work very quickly. The stalks contain comparatively little pyrethrin and the labour engaged in picking should be instructed not to include any stalks when picking flowers. An average boy in the Nilgiris can pick anything from 25-40 lb. per day and an adult may be able to pick 50-60 lb. of flowers. The flowers are usually carried in baskets so as to allow aeration. If the flowers are gathered in a closed vessel and compacted, there is the risk of the pyrethrin being decomposed owing to the heat produced.

Drying

The flowers may be dried either in the sun or in specially constructed driers in which hot air is made to circulate at a fixed temperature between trays containing the flowers. Sun drying will usually take about four days and is possible only in the dry weather and if the acreage is small. During wet weather, and if the quantity of flowers picked is large, it is necessary to have kilns for drying.

For kiln drying, the fresh flowers should be spread out on trays as soon as they are collected, to avoid heating, and should be put into the drier without any undue delay. It is advisable to have plenty of trays for this purpose. The type of tray used in the Nilgiris is made of gauze, through which the dried flowers will not pass. Each tray can hold about 30-40 lb. of fresh flowers. Drying in a kiln should be done at 130° F. Higher temperatures will lead to decomposition of the pyrethrin, and particular care should be taken to see that the temperature in the drier does not rise above 130° F. A thermometer is kept in the drier for this purpose and readings at regular intervals are taken to ensure proper drying without the risk of the pyrethrins being decomposed. In the Nilgiris a drier can dry 1,000 lb. of fresh flowers at a time in about 8-10 hours.

In Japan the loss in weight caused by drying is estimated to be 65-75%, in Kenya it is about 70%, and in the Nilgiris it varies from 72-76%. Usually it is reckoned that 4 lb. of fresh flowers will weigh 1 lb. when dried. After the flowers are thoroughly dried so that they can easily be crumbled between the fingers, they are packed in gunny bags containing 55-60 lb. and despatched to consuming centres. The flowers from the Nilgiris are chiefly despatched to the Government Kerala Soap Institute at Calicut and there it is made into pyrethrum extract.

Cleaning

The dried flower stalks should be regularly removed, as otherwise the yield has been found to go down appreciably. In South India these stalks are easily removed by means of a secateur or a pair of strong scissors. The dry stalks thus removed are kept in the trenches along with the weeds to form a mulch. It is advisable to do such cleaning at least once in two months.

A basket of pyrethrum blossom

The Chelsea Show

The Chelsea Show was held again this year from May 25-27. Her Majesty the Queen attended the private view for the Fellows and Associates of the Royal Horticultural Society, under whose auspices the Show is held. Throughout Great Britain the Chelsea Show is renowned for the magnificence of the flowers exhibited and the fine gardens temporarily set out in the grounds of the Royal Chelsea Hospital.

The flowers were very well arranged in the huge marquee, which, indeed, is a spectacle in itself. The masses of colour and the perfumes which filled the marquee hardly reflected the poor spring weather that this country has suffered. Particularly prominent this year were the azaleas of many different colours and sizes. The roses, begonias, orchids, rock plants and a host of other blossoms together contributed to a sight that is not easily forgotten.

Most of the machinery exhibited was of particular interest to the private gardener and the owners of market gardens. The number of walking tractors must be mentioned particularly. These machines have innumerable uses and are most of them designed for work on small holdings. Besides ploughing, many of the larger models have attachments for cutter bars, tool bars, ridgers, seeders, hedge trimmers, sprayers, trailers, pumps, mowers, and their makers claim that they can be made to do nearly every job that a gardener could require. It has been said that they have been put to such diverse uses as hole-boring and snow-ploughing. These machines were exhibited by Landmaster Ltd., Clifford Aero and Auto Ltd., Rotary Hoes and Raven Engineering Co. Ltd. among many others. Ransomes, Sims and Jefferies were exhibiting their MG tractor, which is suitable for use on larger holdings and has the advantages of the smaller two-wheeled tractors.

Plant Protection Ltd. and Murphy Chemicals had particularly interesting stands. The McAllan flame gun attracted a great deal of interest as an alternative to hoeing and weeding, and as a means of sterilisation. There were many other exhibits of tools, mowers, etc., for the private gardener.

The atmosphere of the Show was one of gaiety and colour and provided horticulturalists, both amateur and professional, with a refreshing and stimulating occasion.

The Agricultural Revolution in Turkey—II

Present Developments and Future Possibilities

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The first article on this subject (WORLD CROPS, **7**, *137, 1955*) *described the great increase achieved in Turkish agricultural production during the last few years. It was stated, however, that, in the authors' opinion, such increases had been possible largely through intensive mechanisation, which had permitted a great extension of the acreage under cereals. It was suggestd that the limit of increase by these methods was probably approaching, and that planning for a further phase of more balanced agriculture should begin. It is the purpose of this article to show the way in which Turkish workers are approaching this problem, and to add suggestions gleaned from discussion with them to our own appraisal of the situation.*

IN the majority of countries where monoculture on a cereal-fallow basis is the prevalent form of land use, depletion of natural fertility, loss of organic matter and severe erosion tend to result, so that yields are usually very low. There may be circumstances in which this is the only workable agricultural system and modifications developed in countries such as Canada may mitigate its inherent dangers, but it will take years before this can be proved.

Although a dogmatic attitude should therefore be avoided concerning the advantages of adopting balanced rotations under all circumstances, it seems logical to develop less exhaustive systems of husbandry as alternatives to the cereal-fallow wherever possible.

Basic problems

Where there are already problems of low yield, erosion and depleted fertility the ploughing of pasture to augment arable acreage only aggravates them, since the stores of fertility are thus progressively reduced and pressure on the remaining grazings is increased. There are two means of preventing this. One is by reducing livestock numbers, but this, in practice, never seems to happen. The only possible method, therefore, is to develop some form of alternate husbandry by which yields from the arable acreage can be increased and livestock numbers maintained without loss of fertility.

Exploitation of the soil's wealth has well-known repercussions and follows well-trodden paths. Removal of forest cover on catchment areas, over-grazing in consequent scrub zones, and ploughing of steep hillsides, all cause rapid deterioration. This is the situation in areas where the older civilisations grew. Gradually agriculture is confined to the gentler slopes and alluvials in the valley bottoms. Turkey in many areas presents just this picture, and it is particularly obvious in the southern coastal region along the limestone chains of the Taurus range.

Until recently this process was slow, since the area ploughed each year was limited by the primitive implements available and a precarious balance had been achieved between arable crops, pastures and livestock numbers. The advent of the tractor has upset this balance and erosion and loss of fertility will inevitably be accelerated unless a fresh equilibrium can be achieved.

Here, then, is a challenge to the Turkish people in general and, in particular, to their administrators, agricultural scientists, pasture, fodder and soil-conservation experts and extension workers. Reversal of this age-old trend is possible if conservational methods are adopted; balanced agricultural development will come with reduction in the present acreage of cereals, and

Hay-making is widely practised, but not on a sufficiently large scale, and crops are usually of poor quality

greater integration of these with fodder crops, pastures and livestock. How this may be achieved without reducing total cereal production will now be discussed.

This is not meant to condemn as impracticable the policy previously adopted. The methods used, in their time and place, were those most likely to yield the required results. However, the agrarian revolution may prove to be a two-edged sword, and loss of soil fertility, if unchecked, may ultimately outweigh the benefits which mechanised farming methods have so far made possible. Furthermore, for economic reasons, the world surplus of cereal products renders a shift away from cereal production desirable.

More fodders are needed. A fine crop of Sudan grass (Sorghum sudanense) *in Western Turkey*

Planning for the future

In Part I[8] it was stated that, although considerable efforts are being made, there is a shortage of research and extension workers, which appears to have borne particularly heavily on pasture, forage and livestock development. In view of this, a carefully co-ordinated plan will be essential to ensure the success of the second phase of Turkish agricultural development, since this will make heavier demands on research and educational services than did the first, and more extensive, phase.

Better land use

It is suggested that the first stage of planning should be the establishment of a *Land Capability Survey*. This survey would be responsible for the development of an overall plan co-ordinating forest, range, pasture, soil-conservation and arable effort.

Its first task would be to define areas according to the most desirable form of land use and thus form a general framework within which regional agricultural development would be strictly controlled. Within each land-use zone experimental work would eventually determine whether alterations in this original plan were justified.

Specific objectives of such a survey might include recommendations for: (*a*) Reafforestation and the creation of forest reserves; (*b*) range improvement and the control of grazing; (*c*) soil-conservation policy; (*d*) drainage, reclamation and irrigation projects; (*e*) the development of new systems of husbandry.

The value of afforestation in the protection of catchment areas, and as an alternative to grazing on the steeper slopes, will be readily appreciated. It is also important to provide local fuel reserves by plantations near villages and to replace the present pernicious system of using dry cakes of dung for fuel. The use of alternative fuels, such as paraffin, to supplement wood should also be encouraged.

The problems of range improvement constitute a major study in a country the size of Turkey. Decisions as to which areas of the range will respond to reseeding and those which are only suited to the slower but less costly regenerative methods can only be taken after considerable investigation. The economics of fertiliser application and weed control in range improvement also require examination. In this work FOA (Foreign Operations Administration of the United States) are providing valuable technical assistance.

Soil conservation presents major problems associated with methods of land tenure. At present large farms, other than those owned by the State and ' . . . except in certain regions like the Adana plain, are few and far between; only one-tenth of the farmers have more than 10 hectares; over two-thirds have less than 5 hectares '[9] (1 hectare equals approximately 2½ acres). The difficulties of obtaining co-operation in large-scale planning, where there are acute fragmentation problems, will be appreciated by those acquainted with peasant agriculture.

Drainage, particularly, appears to

Steep slopes ploughed in a cereal-fallow rotation produce soil erosion

have received inadequate attention in the areas visited and also in proposed development schemes. It may be that in this type of climate the drainage problem—being seasonal—is not as obvious as in countries with heavier and more diffuse rainfall patterns. Nevertheless, the aggregate areas of valley bottoms in many parts of Turkey, which are badly drained and flooded in winter and spring, but dry and under-productive in summer, must be very large indeed. Furthermore, these could be some of the most highly productive farms in the country if the land were reclaimed by drainage and the waters controlled for irrigation.

An assessment of farming systems suited to the various regions of the country, with recommendations as to the proper balance of cereals to other crops and pasture, would be most valuable. In the past the cereal-fallow rotation, despite its obvious drawbacks, has proved a workable system in a peasant agriculture lacking fertilisers and adequate power; but a change can now, probably, be made. This should be investigated thoroughly. Other systems in vogue throughout the country should also be appraised, and altered if required, in the light of new knowledge and facilities.

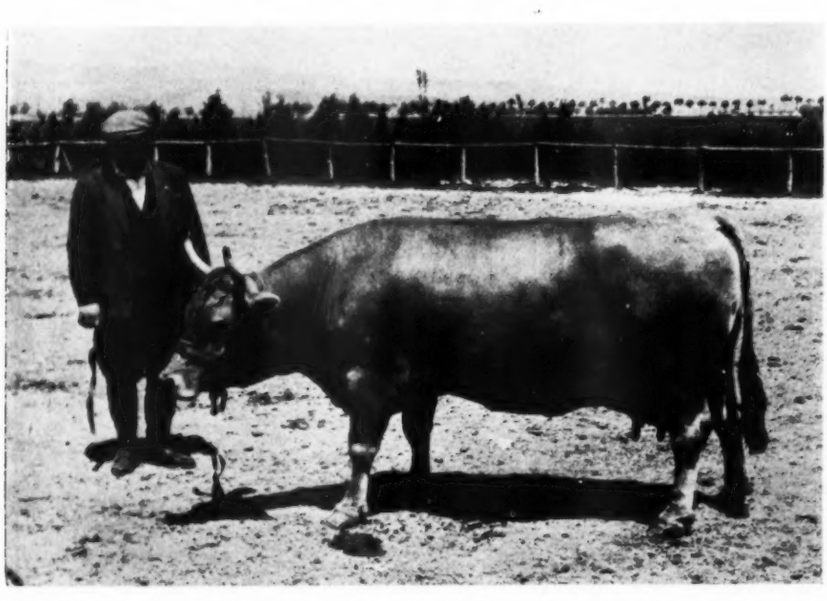
Co-ordination of activities

Already a National Committee on Forage Production has been formed. This includes representatives of veterinary medicine, forestry, farm machinery, State farms, agricultural research stations and FOA, plus various interested co-opted members. It is not known what executive powers this committee possesses, but at the very least it indicates appreciation of the need for co-ordinated activities in forage production and of its central role in agricultural development.

However, the execution of any plan for better land use will need co-ordination of a wider range of agricultural activity than forage production alone if all its requirements for research, demonstration and education are to be satisfied.

One solution would be to establish a central planning organisation, with research, education and extension sections working in close co-operation under one director, and responsible for carrying out the recommendations of the Land Capability Survey. Through co-ordination of the resources available for research and development it could ensure uniformity of policy, and thus eliminate duplication of effort. The allotment of staff, equipment and materials to research stations on a system of priorities according to this policy would permit optimum use of the available research facilities. Arguments exist for and against centralised control of agricultural education, but local authorities sometimes fail to plan curricula so that maximum time is devoted to the subjects of greatest importance in future agricultural development. At present there seems to be a tendency for training in rural crafts to occupy a disproportionate part of the time compared with more fundamental aspects of agriculture at some of the 'group leader' training schemes developed at Turkish State farms.

An important task is to augment the present advisory and propaganda service both in respect of research and extension work. For research the establishment of a central abstracting department would be valuable. This would provide up-to-date information and current publications to research workers even in the most remote areas and would undoubtedly have a powerful psychological influence in stimulating their ideas. To assist extension officers a really comprehensive audio-visual aids section is most desirable. This should not only dispense information through broadcasts and advisory leaflets, but should be prepared to advise extension workers on how best to carry out demonstrations and assist them by means of film and other mobile demonstration units. Where extension workers have large areas to cover, such supplementary aids are particularly useful.



Animals at the sugar factory compare with commercial herds anywhere (Brown Swiss cow)

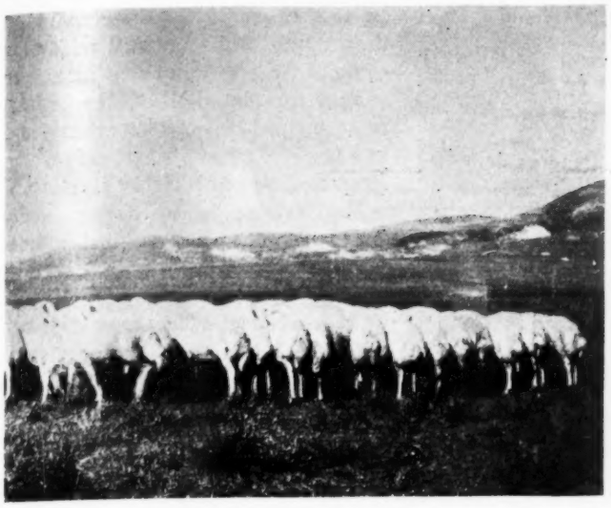
Individual programmes within the overall plan

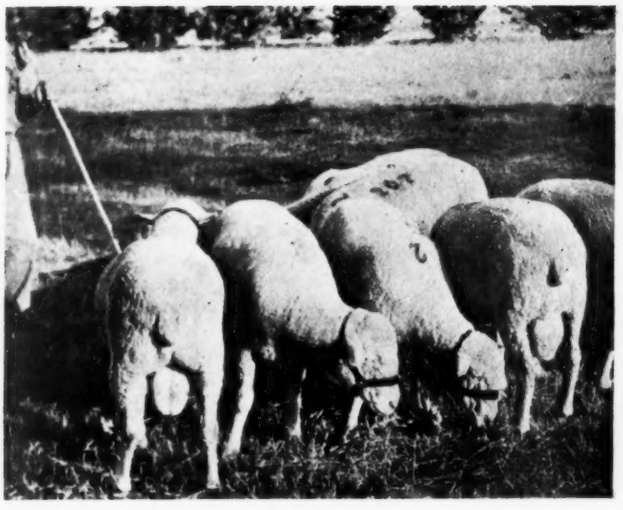
Arable farming

Our first article[8] mentioned the need for caution in advocating the general abolition of the cereal-fallow system. In a country with such varying climatic conditions as Turkey the needs of each zone must be considered on their merits. Broadly speaking, however, ploughing of fresh land and continuous cultivation of cereals and annual cash crops should be replaced, wherever possible, by a system which includes recuperative crops. A proportion of temporary pasture is required, since this will both improve fertility in the arable land and relieve pressure on the permanent grazing.

This could be achieved without loss of total production by improving the yield of annual crops and the following lines of attack seem to offer the best chance of success:

(*a*) *Weed control.* Many fields show a very high weed population. Turkish scientists have been somewhat discouraged by unsatisfactory results with certain selective herbicides, but formulations are continually being im-





Better livestock will be required to take advantage of any improvement in the forage situation. *Will it be fat-tails* (left) *or Merinos* (right) ?

proved, and further research to determine susceptible weed species and safety factors, in relation to the crop, would surely be worth while. An energetic spraying campaign backed by this knowledge, allied to more careful cultivation and the elimination of weed seeds from seed corn, might pay considerable dividends.

(*b*) *Seed certification.* The steps already taken were discussed in Part I; when fully effective they should make a great contribution to improving cereal and sugar-beet yields. However, they could be extended to other crops, such as potatoes (where virus diseases appear to be a serious limiting factor on yield), and herbage crops, particularly grasses and legumes, where shortage of seed is limiting expansion.

(*c*) *Use of fertilisers.* Experimental work undertaken by the University of Ankara has shown a wide prevalence of phosphorus deficiency. However, local fertiliser practice (such as the use in one area of large dressings of nitrogen, but no phosphorus, on legumes) often appears to be based on empirical and possibly unsound conclusions. There is wide scope for further investigation and demonstration in this respect. At present total consumption of fertilisers in Turkey is low and a planned and subsidised campaign to encourage their use would do much to raise yields. In addition to the increase in grain yield, which may be expected when fertilisers are applied to cereals, an increase in the amount of straw is also likely. This would prove a valuable addition to supplies of animal fodder.

(*d*) *Methods of cultivation.* It was observed that farmers in the same area differed considerably in the sowing methods adopted for any particular crop. In some fields of sugar-beet and potatoes poor crops could be attributed to apparently incorrect spacing of rows and plants. This offers a fruitful field for investigation, as does the effect of drilling compared with broadcasting cereals in the drier regions. In this connection development of a very cheap horse-drawn drill might be valuable. It has been shown in certain other countries, where moisture is a limiting factor, that drilling in wide rows can lead to considerable increases in yield, especially if accompanied by weeding between the rows. There is also an important saving of seed.

(*e*) *New rotations.* Research to determine the most suitable rotation for each region, and in particular to examine alternatives to the cereal-fallow system in the Anatolian Plateau, deserves high priority. Simple alternatives to cereal-fallow, such as cereal-forage, may not be the only possibility, even in the drier areas. Leys, composed of sainfoin (*Onobrychis sativa*) or lucerne (*Medicago sativa*), mixtures of these with perennial grasses, or self-regenerating pastures on the Australian pattern, containing such species as *Lolium subulatum* and *Medicago tribuloides*, might be incorporated in rotations. The programme of reseeding village common lands with these legumes, and with grasses such as *Agropyron cristatum*, *Agropyron intermedium* and *Bromus catharticus*, shows great promise and might well lead to some sort of ley system working round the village lands.

Where considerable rain falls in summer the cultivation of sorghum, sunflowers or fodder beet, in rotation with winter cereals and with maize, would improve the supplies of animal fodder. The energetic and successful hybrid maize programme being developed from the State farm near Samsum will increase yields and thus release land for other crops. In drier areas with a moderate summer rainfall a mixture of Sudan grass (*Sorghum sudanense*) with cowpea (*Vigna sinensis*) might prove a valuable annual forage crop. *Sorghum almum*, a perennial closely related to Sudan grass, which is proving most valuable in low rainfall areas of Australia, is also worth a trial.

If the development of rotations can be supported by relevant effort in the fields of seed production and fertiliser practice, there is every likelihood that animals throughout Turkey will be better fed and the increase in soil fertility will more than offset, in improved yields, the reduced acreage of cereals sown each year.

Pastures and grazings

In addition to the introduction of a greater proportion of arable forage crops and leys into the farming system, there is great scope for improvement of grazing, particularly in the Mediterranean, Black Sea and eastern zones of Turkey. This should be accorded considerable importance in plans for

Ancient and modern—a frequent Turkish contrast

future development and the following suggestions may be of assistance in this respect:

(*a*) It is often more economical to reclaim pastures by management rather than reseeding. This may involve control of grazing, fertiliser application and the optimum use of water supplies, including irrigation, water spreading and the construction of check dams, as well as drainage programmes.

(*b*) Experimental work is required, both to determine the policy to be adopted in each agroclimatic zone and to examine the suitability of local and exotic species. A plant introduction section in contact with workers and sources of seed in other countries is most valuable in such a programme. Centralised planning ensures that the various regions of a large country are allocated species most likely to be adapted to their conditions and eliminates waste of effort in testing unsuitable types. Parallel studies undertaken in replicated protected range plots help to determine the extent to which pastures have degenerated and the rate of improvement following protection.

(*c*) Such investigations should indicate which method of range improvement is likely to prove successful in each area. If reseeding is advisable, adaptation trials will indicate suitable species. Where worn-out range land cannot be reseeded economically, prohibition of grazing may allow regeneration to occur. (In one forest reserve where this treatment has been applied the results obtained in a comparatively short period are very striking.) After this, limited controlled grazing must again be permitted to prevent reversion of the improved pasture to scrub. This rotation of resting and grazing is vital to the maintenance of the pasture in an optimum condition once initial improvement has been achieved.

(*d*) Fodder, pasture and range improvement should be closely integrated with soil conservation and forestry programmes on the basis of the land-use survey. Uncontrolled grazing can then be checked because it becomes possible to adopt measures to halt the destruction of forests, degeneration of pastures and consequent acceleration of soil erosion once alternative, and better, sources of fodder are provided. In this work the co-operation of the villages is essential and the establishment of grazing districts, as developed in Greece, with forage reserves on the lines of those in Algeria and Morocco, could be of great assistance in this respect. In one village area near Amasya the progress achieved by such methods was most encouraging.

Livestock husbandry

Better livestock will be required to take advantage of any improvement in the forage situation. The provision of adequate fodder flow to a low-grade animal lacking the potential to make economic use of the extra fodder is unlikely to prove worth while. Livestock improvement should not, therefore, be a sequel to the adoption of a better feeding system, but an integral and parallel part of such development. In this respect there appears to be urgent need for a national policy for cattle breeding to co-ordinate the various regional plans. If the population distribution and present and potential forage supply of each region are taken as the main criteria, a logical policy would be to develop dairy breeds for town dairies, dual-purpose breeds for village pastures, and beef animals on the range.

To ensure an even supply of forage throughout the year, conservation is of the greatest importance. Haymaking is practised on all Haras, on State farms and in many villages. Often, however, well-cured hay was observed, which was low in feeding value through being composed of coarse and stemmy species. Better quality would be obtained if pastures were reseeded with the more leafy species, which could undoubtedly be grown in many parts of Turkey. The same would be true of silage. Silage-making was frequently seen at Government farms and it was encouraging to see an extension officer making silage at a village near Eskisehir.

There are considerable possibilities for creating forage reserves, either on a State-controlled or a village co-operative basis. The techniques and tools of mechanisation developed in the cereal-production campaign could also be applied to this purpose. Such reserves could be used to alleviate shortage of fodder in bad years and as an instrument of range management and soil conservation. They would be of great assistance to extension workers in these programmes and in livestock improvement, because the availability of additional fodder to farmers could be made conditional to their adopting the recommended methods.

Encouraging the farmer

The campaign to increase grain production has demonstrated conclusively that the peasant farmer (like all other farmers) will respond to the stimulus of receiving a reasonable and assured price for his product. His response is greater if he is assisted, as in Turkey, by Government action to provide machinery, good seed, credit facilities and technical advice.

If the Administration will adopt the same methods and vigour in their application in the second phase of agricultural development and similar

incentives can be given to the farmer, progress need not be difficult. It may well be that, as so often happens, the farmers will not only co-operate willingly, but will lead the way.

The problems are complex, but they will only be solved by working with, rather than for, the farmer, since without his willing co-operation the best plans cannot succeed.

Summary

In Parts I and II of this paper the renaissance of Turkish agriculture has been discussed.

During the first phase of this renaissance the development of mechanisation has permitted cultivation of annual cash crops (particularly cereals) on an unprecedented scale. As a result, total production has risen from 2,700,000 tons in 1927 to 14,300,000 tons in 1951, and national prosperity has increased accordingly.

The methods employed to achieve such an expansion, although justified by urgent need, have inevitably been exploitive. Experience from other countries which once followed similar policies has indicated that, after a varying period, they cannot be maintained without grave danger to soil fertility, and more stable and conservative systems must then be adopted.

There are indications that this time may be approaching in Turkey. The inherent stability of soils in the Anatolian Plateau has so far prevented wind erosion, but research indicates a progressive depletion of phosphates and nitrogen.[8] Under the cereal-fallow system little but the stubble is returned to the soil and in Turkey dung is largely used for fuel. This means that the reserves of organic matter must also be falling. On the hills erosion by water is becoming serious. The animal population has doubled since 1925, although the area of grazing has been reduced to allow for increased cereal production. Extra pressure on pastures, which are already over-grazed, will progressively increase the rate and extent of this erosion. It is clear that new and more balanced systems must be developed if Turkish agriculture is to continue to prosper.

In this second phase the keynote should be production of more forage crops (especially legumes), better pastures and the integration of these with improved livestock. Increased fertility within the arable rotation will lead to better yields and the creation of reserves of forage will enable conservation measures to be undertaken in mountain, forest and range areas, with the co-operation of the villagers. The execution of this programme will require an increase in research and extension services, particularly in the related fields of forage, agronomy, livestock improvement and natural resources. The whole policy should be based on a survey of land capability, and in the initial planning particular attention should be given to co-ordination to ensure optimum use of technical staff and facilities.

Excessive small-grain cultivation in recent years has led to a surplus on world markets. A trend towards mixed farming in countries such as Turkey, whose economy is heavily dependent on cereal production, is therefore desirable for economic as well as for agricultural reasons. Support from the Government, along the lines mentioned in the preceding section, would provide the framework upon which the technician and farmer could build. Such a policy (which could easily be reversed should temporary expedient demand) can only have beneficial results.

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British Equipment for Iran

The British Overseas Engineering and Construction Corpn. Ltd. obtained in June 1954 one of the most important contracts ever received from Iran for agricultural machinery. This contract included orders for the following types of British equipment: tractors, combine harvesters, implements, trucks and mobile workshops. It is worth £1,600,000 and is one of the first major contracts signed by the Iranian Government after the resumption of normal relations with Britain in 1954. The contract was the result of a four-month survey of agricultural needs over the whole of Iran and was finally discussed and negotiated with the engineers of the Agricultural Bank of Iran. This is an indication of the very high priority which the Iranian Government now places on the rapid modernisation and mechanisation of its agricultural methods.

One of the conditions laid down by the Agricultural Bank of Iran was that 10 of their employees be trained in this country as specialists in the use of the equipment ordered. These specialists arrived in England in September 1954 and have attended courses at the factories of the supplying firms, that is, Massey - Harris - Ferguson (Export) Ltd., Ransomes, Sims and Jefferies Ltd., the Austin Motor Co. Ltd. and F. Perkins Ltd. Recently, after a stay of just over six months, they returned to Teheran to take up important posts with the Agricultural Bank of Iran. They will supervise the reception of the equipment ordered from Britain, its subsequent sale to the Iranian farmer, and its maintenance by efficient and regular after-sales service. The B.O.E.C.C. has also established its own organisation in Iran and will act in a servicing and advisory capacity.

Well over half the machinery involved has already been shipped, including 750 tractors, 745 diesels, combine harvesters and other equipment, as well as a quantity of spare parts. Shipments are continuing monthly and will be completed by December 1955.

It is considered that this contract will do much to cement friendly trade relations between Britain and Iran, and will provide Iran with a group of trained agricultural engineers and the foundations of an up-to-date mechanised farming industry.

To Authors and Readers

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'The Rainmaker,' equipped with specially designed instruments, has made many flights through cloud with Australian scientists aboard to investigate the mechanics of natural rainfall and to create artificially induced rain

Developments in Australian Agricultural Research

JOHN SIDNEY

Since the second world war, Australian scientists have been making great steps in agricultural research, particularly with regard to mineral deficiencies of the soil. They have also been carrying out research into the making of rain, combining detailed research in the laboratory with airborne work in the clouds.

ALMOST unnoticed in the Northern Hemisphere, an agricultural revolution is taking place in Australia which may prove to be one of the major agricultural developments for many years.

Scientists attached to the Commonwealth Scientific and Industrial Research Organisation have estimated that these developments will not merely double or treble the immense Australian production, but could confer much the same benefit on many parts of the world.

The Australian agricultural revolution is dependent upon two main fields of research: that into mineral deficiencies in soil, and that into large-scale artificial rain-making.

Research into mineral deficiencies

The first official announcement came just over a year ago from Dr. J. Griffith Davies, the Associate Chief of the Division of Plant Industry of the C.S.I.R.O. He said that the results of investigations into mineral deficiencies of the soil may enable Australia to double its present livestock population; Australia, at present, carries 127 million sheep and 14 million cattle. A figure of 200 million sheep in the foreseeable future was suggested early this year by Mr. Ewen Waterman, the Australian member of the International Wool Secretariat.

Dr. Davies thought that Australia would be able to open up more than 340 million acres of undeveloped land previously believed to be infertile. He added that 'recent investigations had shown that the most important reason for soil infertility was deficiency of nitrogen and trace elements, including zinc, copper, molybdenum and cobalt. In south-eastern Australia mallee-scrub country was now carrying two sheep to the acre where previously 20 acres carried only one wether. Superphosphates, copper and zinc had been added'.

Dr. Davies said that on this scale New South Wales and Victoria could carry 94 million sheep more than their present 70 millions. In Queensland, a further 19 millions could be supported in addition to the present six millions.

Commenting on Dr. Davies's statement, the Dean of the Faculty of Agriculture at Sydney University described the work of the Commonwealth Scientific and Industrial Research Organisation as 'the biggest thing that had happened in agriculture'. He said 'the most important aspect of the research was that it was both economical and practicable by an ordinary farmer who wanted his land to be more fertile. Relatively small applications of the deficient trace elements would provide fertility over considerable

periods ranging up to seven years in some cases '.

Artificial rain-making

Australian research in cloud physics has been going on for over seven years, and during this time the researchers have demonstrated that clouds can be stimulated into giving out their moisture by ' seeding ' with ' dry ice ' (solid carbon dioxide) pellets or spraying their bases with water. Over 100 controlled experiments have been carried out recently. Dr. E. G. Bowen, who is in charge of the work, announced that the two methods were now entirely successful. These methods were uneconomic for large-scale rain-making at the moment, but he was confident that further problems could be solved within five years.

Large - scale, cheap rain - making would bring its richest benefits in the marginal rainfall areas of Australia. Dr. Bowen thought it would be possible to increase the annual rainfall in these areas by up to 15%.

There is an immense marginal area in eastern Australia, inland from the Great Dividing Range, 300-500 miles wide and 2,000 miles long. Not only could the rainfall be increased here, but, even more important, it could be made to fall when it was most needed. In the wheat belts rain is needed at the period of initial growth in the spring. Every ½ in. of rain in the mallee district of Victoria has been estimated to be worth £1 million to the farmers there.

Artificial rain-making would mean, too, that some droughts could be broken. The techniques would be particularly suited to northern Australia, where monsoon clouds often hung in the skies for long periods because there are no salt particles in the air to turn them into rain. These clouds could be ' triggered off ' and farmers would have rain when it was needed at sowing time.

Methods

About 30 years ago Bergeron, the Swedish scientist, suggested that rain fell from clouds in which ice crystals existed. Acting on this the Australian rainmakers have been ' stimulating ' clouds by adding ice crystals by means of ' dry ice ' pellets, and, to a lesser extent, by the use of silver iodide, around whose nuclei ice crystals will form.

Ice crystals form normally in, or drop into, cumulus clouds which have climbed to heights where the temperature is well below freezing point. The ice crystals grow by collecting the water droplets and then fall because of their weight, falling either as snow or as rain, depending on the temperature below.

The Australian rainmakers have also been ' triggering off ' non-freezing clouds in which there are, of course, no ice crystals. These deep clouds rain when there is coalescence, *i.e.* when up-draughts whirl the droplets about until the larger ones grow bigger by colliding with and gathering the smaller ones to themselves until they become so heavy they fall out of the base of the cloud.

However, the cloud may be made up of droplets too regular in size to coalesce. By spraying the bases of clouds with water Australian rainmakers have been setting off the process.

In other experiments they have been spraying the bases of non-freezing clouds with electrically charged nuclei around which water vapour condenses and forms droplets.

Attached to the leading edge of an R.A.A.F. Dakota's wing is equipment specially designed by the C.S.I.R.O. to measure the water content of clouds. It houses a continuously moving paper tape, automatically drawn past a narrow slit open to the air stream; resistance is measured on a recording milliammeter in the cabin of the aircraft

Economic limitations

Large-scale rain-making remains uneconomic at present because of the need to have a large fleet of planes and crews grounded until suitable conditions arise. Most of the Australian tests have been carried out near Sydney, where it was found that periods of suitable conditions might be separated by as much as three weeks, even though 100 suitable days might occur over a year.

Dr. Bowen thought that artificial rain-making was economic in special circumstances, *e.g.* to ' trigger off ' rain clouds during a drought, or at the initial period of growth in cereal crops. A cloud could be treated at the cost of about £A25 and would give some rain over an area up to 50 sq. miles. (The first successful rain-making experiment in February 1947 set off a cloud which rained for an hour and a half over 40 sq. miles and produced half an inch of rain. Other experiments since have yielded much more rain.)

Australian scientists of the C.S.I.R.O. joined with American scientists in experiments carried out at Hawaii towards the end of 1954 to learn more about warm rainfall. Hitherto most research work has been carried out into the nature of cold rainfall. Hawaii was chosen because it has a fairly reliable rainfall and because it is situated approximately halfway between U.S.A. and Australia.

While the Hawaiian tests were proceeding over a period of 60 days—20 of which were rainless and useless for research into warm rain—work continued in Australia in the north-west of Queensland.

During the tests Dr. Bowen announced that a way had been found to make rain fall, under certain circumstances, when test particles were sown into clear air to cause cloud to develop later.

But he emphasised that there would be some time before cheap rain could be made. However, when this can be done, then Australian agricultural development, aided by the discovery of the vital part played in soil fertility by trace elements, will progress rapidly.

Photos: Australian News Information Bureau.

Major Developments in American Farming

THE production of corn, potatoes, cotton, tobacco, fruit and other crops in America continues to astonish the world. So astounding are some of the increases during the last two or three decades that they are almost incredible. The overall increase is now approximately 45% higher than the 1935-39 level. This may not seem sensational in itself, but its true significance is seen when it is realised that the gross farm income for the U.S.A. is now in excess of $40 billion per annum.

In 25 years the yields of corn, cotton, tobacco and potatoes have doubled. Only 20 years have been needed to double egg production and less than that to increase the milk yield by nearly a fifth.

Large-scale farming

These figures, however, tell only a fraction of the story. The whole picture is seen only when it is known that the increases have been achieved with less workers, with less land devoted to individual crops, with less farms and fewer farmers. Large-scale farming is in the ascendant, with small-scale farming steadily shrinking. Tenant farming has been in decline for a quarter of a century. In 1930 no less than 42% of all American farms were in the hands of tenants. The figure is now down to less than 27%. In the same period the number of farm owners increased by about a third of a million. It has been a tendency, however, for the large farms to absorb the small ones, and this has been most pronounced in the cotton-growing South, where the mechanisation of production has given the advantages to the large producers.

Larger farms provide only one factor in the change which has so boosted production. In fact, American farming has passed through a revolution in which many different agents have played a part. Not the least of these has been the price-support programme of the Government, which has provided the incentive to produce maximum crops. The reward has been assured and the farmers have responded accordingly. They have responded to such an extent that production per farm worker is now more than double what it was in 1910.

Decreasing farm population

During that period the farm population has fallen by some 8 million workers and farmers, and the number of farms has declined at an annual average rate of about 25,000. Compensation for these trends is found in the fact that the size of farms has increased since 1920 by an average of about 65 acres.

With more land to plan and confident that his planning would be rewarded, the American farmer has taken in additional land in the western ranch lands and has made every effort to achieve maximum production by maximum efficiency. He has welcomed machines in ever-increasing varieties and numbers and he has been receptive to the suggestions of the scientist and chemist. Special attention has been paid to soil conservation, to the increased use of fertilisers, to more effective insecticides, new freezing techniques and better methods of packing and storing.

Forty years ago only 1,000 tractors were to be found on all America's millions of acres. Today the number is nearing the four million mark, and the increase in the last 10 years has been in the region of two millions. Combines, threshers, corn pickers and milking machines are also widely used.

A further factor in the farming revolution has been the extension of electrical power under the Rural Electrification Administration. In 1940 only a third of the farms were served by electricity, whereas today over 85% of all farms have this advantage.

That American farming should require a revolution in the use of the motor car strikes the observer as strange, for no country in the world is as automobile-minded as the U.S.A. In spite of this, the American farmer

(Left) *Sprinkler irrigation system in olives.* (Right) *Contour-planted and irrigated early tomatoes in California. Water is brought to the furrow by means of a* V*-shaped wooden flume. Holes in the bottom of the flume above the furrow are opened for water delivery*

preferred the horse and cart as a means of personal transport until as recently as 1945. It is only since then that the motor car has come into extensive use in agricultural America.

Changing crop pattern

One of the most important agents in increasing farming production in the U.S.A. is found in the crop changes which have taken place during and since the war. The shift in the acreage of hay from grasses to the higher-yielding legume hays with a higher protein content has been remarkable and has done much to help to balance the livestock ration.

The expansion of hybrid seed corn is another significant improvement. Hybrid seed corn, first produced in 1922, covered only 143,000 American acres in 1933. Fifteen years later the number had rocketed to 66 million acres. This hybrid seed produces at least one-fifth more yield per acre than does the open-pollinated type. And the increase is usually as high on poor as on good land. In 1948 the corn crop was an all-time record of 3.6 billion bushels. Had hybrid seed not been used, a minimum of an extra 15 million acres would have been needed to produce the same amount.

Citrus fruits have also assumed an important place in American agriculture. Production has been expanded so much that it now forms close on 50% of the total fruit crop. This means that there has been a threefold increase in the short space of 15 years, the annual total now amounting to approximately eight million tons.

It is evident that American farming has reached a very high degree of efficiency, although no one denies that there is still room for further improvement. There can be little doubt that guaranteed prices have formed the basis for the immense advances that have been made. These have persuaded the farmer that he could invest safely in new machinery, in taking in more land, in intensive cultivation and in adopting new methods of crop production and protection. He looks favourably upon the co-operative Agricultural Extension Service created by the Government to bring him into closer touch with new discoveries and improved methods.

The American farmer, in fact, having already travelled far and fast, is still confidently, as he says himself, ' going places '.

Photos: Soil Conservation Service, United States Department of Agriculture.

Indian Paddy Machinery

TO THE EDITOR

Dear Sir,

As a regular subscriber to WORLD CROPS I read the article entitled 'Indian Paddy Machinery in Ceylon' (7, 168, 1955) with more than ordinary interest, as this plantation cultivates paddy on a fairly large scale as a plantation crop. However, I disagree with paragraph five of this article, where it is mentioned that it costs less to cultivate with this tractor than with bullocks. I also challenge the costs of bullocks given in the article. Ceylonese farmers would be rich men if these figures were paid. I have bought five pairs of bullocks in the last year and the average cost per pair has been Rs. 170/- only. It costs absolutely nothing to feed them, as they graze on any piece of grassland available. Ploughing with the ' C ' plough, which is the biggest in Ceylon, a pair of bullocks will do an acre in two days and the job is as good as with a tractor.

And now to costs. A ploughman is paid Rs. 3/- a day, which is higher than the wage paid to a tea or rubber worker, so that it costs in wages only Rs. 6/- per acre. What tractor can equal this cost? A pair of bullocks with a Burmese toothed harrow will puddle an acre in one day. Cost per acre, Rs. 3/-. Total cost per acre, Rs. 9/-.

I have tried the rotavator and other types of tractors and found that all of them got bogged in the mud at some time or other. The cost of maintenance of these tractors is high, and from experience I feel that for low cost the Ceylon buffalo is hard to beat.

Yours faithfully,

B. WARUSAVITARNE,
Managing Director.
Gallinda Plantations Ltd.,
Ceylon.

April 18, 1955.

NEW BOOKS

Tillage Implements

By G. C. Mouat and F. Coleman. Pp. xii + 170, illustrated. London: Temple Press Ltd. 1955. 21s.

Although tillage is a more difficult subject than most on which to write something that has not already been published elsewhere, the authors of this book seem to have found little to say that is original. The text and illustrations devoted to mouldboard ploughs, in particular, must appear familiar to anyone who has read the booklet 'Tractor Ploughing,' originally written by the N.I.A.E. and now produced by the N.A.A.S. It is not, then, a book for someone who reads widely on agricultural engineering subjects, but it does collect conveniently together from many sources information for students and others. It is well illustrated and the publishers are to be congratulated on adopting a layout in which the illustrations are so close to the appropriate text.

Because the book is confined to one aspect of agricultural machinery, the authors have been able to devote more space to each implement than is possible in a general book. Taking the chapters devoted to ploughs then, it is disappointing to find statements like 'The socket share has little to be said in its favour, although its extensive use persists on semi-digger bodies' set down without the reasons for condemning this type of share—probably the most widely used on general-purpose bodies in Britain. One feels, too, that if the authors had done much ploughing in an English winter they would have noticed how much easier the socket share is to change than other types. In the same section the bare statement 'The sword blade share is used on certain soils, particularly under swampy conditions,' does not really help in defining what this unusual share is like or when it should be chosen. Users of the Grub-breaker plough may disagree, too, with the statement that its draught is high, particularly when the figure of 3,800 lb. quoted for a 24-in. × 15-in. furrow on medium soil, gives a soil resistance figure of only about 10½ lb. per sq. in. The section devoted to the 'effect of plough draught on the tractor' seems at first glance to be a useful new contribution until it is realised that no account is taken of the weight of the plough and the fact that the vertical component of the soil load on a body and disc coulter acts upwards. The authors thus miss the vital part that the weight of a plough plays in penetration, maintenance of depth and loading of the tractor wheels.

It would be possible to make similar comments on other sections of the book if space permitted, so that the overall impression is one of disappointment that the authors have missed a chance of producing the comprehensive and authoritative book on tillage implements that is needed.

J. C. HAWKINS

Proceedings of the Second British Weed Control Conference, 1954

Pp. x + 668 (in two volumes). London: The Association of British Insecticide Manufacturers. 1955. 30s.

The 'Proceedings of the British Weed Control Conference,' held at Harrogate in November 1954 are now available. 'The conference was organised by the British Weed Control Council, which was set up at the business meeting held at the conclusion of the first British Weed Control Conference in November 1953. One of the functions of the Council is "to arrange a Natural Weed Control Conference at such intervals as shall be considered desirable and to publish its proceedings." It was decided by the Council that a second conference should be held in 1954 on similar lines to the 1953 conference to provide again an opportunity for all those interested in the technology of weed control to hear the latest developments and to present and discuss the results of their investigations and experience.'

The two volumes for the 1954 Proceedings contain the 13 formal papers and 47 research reports, together with the discussions that followed. The formal papers covered the following subjects: the position of herbicides in British agriculture; rotation of weed-killers; spraying machinery; economics of commercial application; legal aspects of spray damage and injurious weed seeds; weed persistence and disposal; selective weed control; and absorption and herbicidal activity.

The research reports deal with: horticulture; grassland; herbage seed crops; legumes; cereals; row crops and flax; control of grass and roadside herbage; new chemicals; experimental techniques; seed-drill survey; woody weeds with particular reference to the colonies.

The report of the recommendations sub-committee and a list of members are also included, and a 25-page index covering both mimeographed volumes is bound in with Volume 2.

A Report on Cacao Research, 1953

Collected. Pp. 87. St. Augustine, Trinidad: The Imperial College of Tropical Agriculture.

Since 1930, when the Cacao Research Scheme was started at the Imperial College of Tropical Agriculture, the annual reports have been composed mainly of scientific papers under the names of the research workers concerned. This method of presenting the results of research has the merit of compounding much of the scientific literature on the crop into one series of publications, but, on the other hand, such reports are often relatively inaccessible (compared with regularly issued journals) to workers on other crops, and usually seem incomprehensible to most planters and agriculturally minded administrators. These reports, being annual only in name, are valuable chiefly because they encourage the publication of interim accounts of long-term investigations that cannot be described in scientific journals until completed, by which time much interesting detail is lost in the condensation necessary for publication today.

The Report on Cacao Research for 1953 has an admirable introduction which serves as this latter type of report. Although too brief in places, this introduction gives the essential points in the papers that comprise the rest of the report, and also mentions research in progress and contemplated. As this is all that most non-scientists will attempt to read, it might well be expanded in future reports to give them a fuller picture.

The papers in this report deal with widely different aspects of cacao cul-

tivation. Some are progress reports on long-term experiments like those on shade, fertiliser and cultural treatments; others describe completed investigations—a new solar fermentary and a new technique in vegetative propagation. This review will not attempt to discuss them all.

An account of the cacao collecting expedition to Colombia contains interesting observations on wild or ' escape ' cacao types, and descriptions with photographs of the various species of *Theobroma* found. Although there can be no question of the immense value of this expedition, it is disappointing to read that seed of so many species either was not present or failed to germinate in Trinidad. It would seem advisable to provide future expeditions with means of sending back vegetative material, difficult and expensive as this must be under the prevailing transport conditions. Establishing as complete a collection of *Theobroma* species and types of cacao as possible is laying the foundation for future breeding work. The production recently of interspecific hybrids at the West African Cacao Research Institute shows that plant breeders need not confine themselves to the species *T. cacao;* indeed, a study of allied species should contribute materially to an understanding of the genetic constitution of cacao, and may even prove or refute the hypothesis that certain characteristics of Criollo cacao, such as white cotyledons, are the result of crossing with another species in the comparatively recent past. White cotyledons have yet to be found in truly wild cacao, but are the rule in all other species of *Theobroma*.

Investigations into the effects of spacing, shade, mulching and fertilisers are of immediate interest to planters and recent results suggest reasons for some of the anomalies in field practices in different countries.

Most economic questions are omitted from this report. To the ' one comprehensive question ' stated in the introduction (p. 4), ' In what artificial environment can a cacao tree . . . yield the most beans of the desired quality?' should be added the word ' economically '. In discussing spraying against witches' broom disease it is stated that, unless pod infection is at least 15% and yield above 800 lb. of dry beans per acre, spraying against witches' broom alone is unlikely to be profitable (p. 66). Surely the important factor is the price obtained for the crop per acre in relation to the cost of production?

Trinidad is fortunate in having only two insect pests of economic importance—thrips and the cacao beetle. Thrips have been studied intensively in the past and work on the cacao beetle is now reported. Although only a regional problem at present, with its preference for unshaded trees this pest might well become a serious problem if established in West Africa—a possibility to be faced with present airline routes.

A valuable contribution to the report is the second paper on a survey of minor pests of cacao; the first appeared in the 1952 report. These minor pests become relatively more important in a crop as the major ones are controlled and the standard of cultivation is improved. It is as well to have the basic information on life histories at hand should any increase in numbers occur owing to an ecological change, or should one attain importance disproportionate to the damage it causes, as, for instance, if it is found to be spreading a disease.

One facet of cacao growing not covered by entomological research, not only in Trinidad, is that of pollination. It is now some 15 years since the importance of certain midges was recognised, and still practically nothing is known about the conditions that favour their breeding and flight, and still less about the effects of spray chemicals on pollination. With the planting of clones of cacao, some requiring cross-pollination and with differing flowering seasons, ignorance of conditions that favour pollinating insects will become increasingly serious.

The reviewer has not commented on all 11 papers in this report; important papers on nitrogen changes in leaves developing under different light intensities, and on soil conditions affected by shade, have not been mentioned, although no less interesting than those that have been. Like its predecessors, this annual report will be studied and frequently re-read by those researching on this fascinating crop; and if others can be induced to read the introduction, they may find it hard to resist going further.

A. F. POSNETTE

Wartime Agriculture in Australia and New Zealand, 1939-50

By J. G. Crawford, C. M. Donald, C. P. Dowsett and D. B. Williams, and A. A. Ross. Pp. 354, illustrated and maps. Stanford University Press. London: Oxford University Press. 1954. $7.50.

This is the fifth book to appear in the Food Research Institute's projected series of some 20 volumes dealing with war-time management of food and agriculture in various countries. Unlike most countries, the problems of Australia and New Zealand, discussed in this book, were those of surplus producers, of managing agricultural production to meet the changing requirements of the Allies.

Attention is directed to the pre-war character of farming in both countries, followed by an account of varying demands as the war progressed, the major problems encountered and the adjustments made in policy and administration during this period. Consideration is given to the manner in which scarcities of manpower, materials and equipment were met, the use of farm price policy, means of distribution, and post-war problems resulting from war policies.

Difficulties in adjusting agriculture to war-time needs were greater in Australia than in New Zealand. Whereas New Zealand is governed as a single unit, control of production in Australia is normally in the hands of the States and control of exports is a function of the Commonwealth. Furthermore, the principal products of Australia (wheat and wool) were on the low-priority list of Allied needs, but those of New Zealand (meat and dairy produce) were in great demand. Therefore, New Zealand had merely to expand her main industries, but Australia was compelled to alter drastically her whole system of farming.

There were, however, many problems common to both countries. Both entered the war with low reserves of farming equipment, Australia because she had not fully recovered from the severe depression of the 1930s, New Zealand owing to an adverse trade balance restricting imports of many essential commodities. The main war-time problems of both countries were concerned with manpower, machinery, fertilisers and transport.

Criticism has been levelled at the

Governments of both countries regarding the handling of manpower. The military need was paramount in the early war years because of the fear of invasion; when this crisis passed there was reluctance to appreciate that the maximum war effort could be achieved by reducing the armed forces in favour of agricultural development. Under Lend-Lease both countries received a considerable volume of agricultural machinery which contributed materially to the mechanisation of agricultural production, thus easing the manpower position.

For the vital years of the war limited supplies of fertilisers, particularly phosphates, were a serious obstacle to production. A system of rationing available supplies was introduced into both countries which achieved reasonable success.

Transport, storage and marketing difficulties were met in several ways. The storage problem was eased by dehydration, canning and, in the latter part of the war, by supplying the U.S. forces in the Pacific area. The chief customer, however, was the U.K.; Australia and New Zealand strained every effort to satisfy U.K. requirements and met with considerable success in this direction. In Australia high-priority crops were vastly expanded and objectives substantially met, and New Zealand maintained a high level of productivity. The dairy industry in the latter country emerged in a sounder position than at the outbreak of war.

The authors maintain an admirably detached view on all aspects of their subject. They commend where they consider that praise is due and criticise where, in their opinion, the farmer or the administration was at fault. They feel that Australian agriculture carried on unguided, uncertain and uninspired during the early war years and this inevitably resulted in a lag in the adjustment of agriculture throughout the war. As to New Zealand, the authors consider that weaknesses sprang mainly from absence of planning rather than from misplanning, and there was often a definite lack of co-operation between Departments, which hampered fully effective work. On balance, however, whatever the weaknesses in either country, Australia and New Zealand made a very signal contribution to the Allied war effort, and the present volume is a valuable study of this achievement.

D. H. GRIST

REPORTS and PUBLICATIONS

Mechanical Crop Production Scheme, Ministry of Agriculture, Sudan Government

One of the objects of producing this report was to assemble all relevant information on which the future policy of mechanised agriculture in the Sudan could be based. As it contains a great deal of information of general interest, it is printed in the hope that it may be of assistance to those who are faced with similar problems. It should be noted that it does not necessarily convey the policy of the Sudan Government on mechanised agriculture in the Sudan.

Two and a Bud, Newsletter from Tocklai Experimental Station, Cinnamara, Assam (Indian Tea Association Scientific Department)

This issue of the newsletter contains abstracts from the proceedings of the 11th annual conference held at Tocklai from December 6 to 8, 1954. Three topics were selected for discussion—(1) withering, (2) shade, (3) drainage and soil erosion—and these were introduced by short addresses by senior officers. The discussion was too lengthy for recording in this publication, but summaries of introductory addresses on the first two topics are given.

Horticultural Abstracts, 25, 1955, 1

A copy of the 25th Jubilee Volume has been received by us. This journal is published by the Commonwealth Bureau of Horticulture and Plantation Crops. The Bureau is one of a group of bureaux and institutes covering the following subjects: agricultural parasitology, animal breeding and genetics, animal health, animal nutrition, biological control, dairying, entomology, forestry, horticulture and plantation crops, mycology, pastures and field crops, plant breeding and genetics and soil science.

Commonwealth Agriculture, London, 1955. London: H.M.S.O. 2s. 6d. net

A memorandum on production prices and trade prepared in the Intelligence Branch of the Commonwealth Economic Committee.

Colonial Development Corporation Report and Accounts, 1954. London: H.M.S.O.

An account is given of new projects undertaken and of the project from which the Corporation has withdrawn, namely, Yundum Farm. There are 56 continuing projects and investigations. Capital sanctioned increased from £43,513,000 in 1953 to £47,822,000 in 1954. The capital employed, excluding expenditure on abandoned projects, was £28,477,000; £25,349,000 last year. Share of primary production fell by ½% to 55.5%. During 1955 decisions will likely be taken about the future of projects, including Usutu Forests, Nyika Forestry Development Syndicate and Tangold Milling Co. Ltd., which might involve commitments to largely increased expenditures on primary production.

A Guide to Cocoa Rehabilitation Under the Cocoa Subsidy Scheme, 1954. Cocoa Board of Trinidad and Tobago

The Cocoa Subsidy Scheme, which commenced operation in 1945, has been previously described in booklets produced by the Cocoa Board, the first edition of which was published in 1949, and a revised edition published in 1951. Since then there have been variations to the rules and regulations covering the scheme, and this booklet is intended to bring up to date and incorporate these changes. The changes presented in this edition had effect from the planting season of 1954.

This booklet has been prepared with the object of acting as a guide for growers already belonging to, as well as for those intending to take advantage of, the Cocoa Subsidy Scheme. The text has been presented in two

parts: the first, compiled by Mr. E. R. Moll, Chief Rehabilitation Officer, Cocoa Board, deals specifically with the rules and regulations of the Cocoa Subsidy Scheme; and the second, prepared by Mr. L. L. de Verteuil, Cocoa Agronomist, Department of Agriculture, sets out advice on field operations necessary to establish clonal cocoa.

Institute of Seaweed Research, Annual Report, 1954

Since the end of the second world war the British alginate and seaweed-meal producers have built up a new industry worth over £600,000 per annum, using more than 30,000 tons annually of an indigenous crop which, during the early part of the century, had been neglected. This has brought employment to areas where it was badly needed, particularly in Scotland, where six seaweed-processing factories and nine additional collecting centres are now in operation. The year under review has been one of the most successful in the history of the industry.

Progress Reports from Experiment Stations, Northern Nigeria, Season 1953-54. The Empire Cotton Growing Corpn.

It is reported that the season 1953-54 was a good one. Rainfall over most of the cotton-growing areas was such that the food-crop planting was completed in time for cotton to be sown nearer to optimum date than usual. Hence, although late rains were not exceptionally good, and indeed poor in some areas, the bulk of the crop gave a fair yield. Picking was much earlier than in some recent seasons. The report includes headings such as ' Plant Breeding ', ' Studies of Bacterial Blight and Seed Disinfection ', ' Agronomic and Fertiliser Experiments ', etc.

Report and Accounts of the Land Settlement Association Limited for the year 1953-54

This report reviews the trading and finances of 697 tenants who were in occupation of their holdings for the full year ended December 31, 1953. At that date the total number of the Association's tenants was 782.

The average net income earned by each smallholder during the year 1953-54 was £544, representing the reward to the tenant for his own labour and the help given in many cases by his wife and family, with an element in respect of his own capital invested in the holding. This figure does not take account of the loan repayments and charges due from the tenant, or of the value of the produce consumed by his family. The total sales of produce amounted to £1,363,594, giving an average per tenant of £1,957, an increase of £58 on the previous year.

The West African Institute for Oil Palm Research, 1955. Lagos: Nigerian Information Service

A report on the inception and activities of W.A.I.O.P.R.

Bulletin of the Zanzibar Department of Agriculture for Quarter ending December 31, 1954

A short publication reviewing the work undertaken by the East African Department of Agriculture, which includes a report on hybrid cassava varieties and nursery technique in derris cultivation. Space is devoted to work on cloves, citrus bud mite, and soil conservation in Pemba.

Memoirs of Forestry Division, No. 6. Ministry of Agriculture, Sudan Government

We have received a copy of this publication, which is devoted to ' Working Plan for the *Acacia nilotica* Forest Reserves, Gezira Circle ' by G. A. Booth.

FAO Publications

We have received copies of *Legumes in Agriculture*, 1953; *Tree Planting Practices for Arid Areas*, 1955 (this paper deals with seed, nursery and planting practices for arid and semi-arid zones in the Near East); *Tree Seed Notes*, 1955 (a companion paper to ' Handling Forest Tree Seed '); *World Forest Resources*, 1955 (results of the inventory undertaken in 1953 by the Forestry Division of FAO); *Report of the Third Conference on Wood Technology*, 1955 (before the conference working parties of members and the technical panel on mechanical wood technology carried out special assignments allotted by the conference and then reported back the results of their work); *Report of the Third Meeting of the Working Party on Mediterranean Pasture and Fodder Development*, 1954 (summaries of discussions which dealt with regeneration of natural vegetation, fodder reserves, seed production, etc.); *Report of the Technical Meeting to Consider the Formation of an FAO Working Party on the Development of the Grazing and Fodder Resources of the Near East*, 1954 (the summary of discussion and recommendations in this report indicates the wide range of subjects which were under consideration).

Report on the 1950 *World Census of Agriculture, Vol.* 1, 1955. 10s. The 1950 World Census of Agriculture has been a major project in FAO's work for a number of years. The importance of this work was emphasised and the project itself supported at successive sessions of the FAO Conference.

The ' Program for the 1950 World Census of Agriculture ', published by FAO in Washington in December 1948, which provided the framework for the world census, was formulated after a preliminary programme had been submitted to governments, reviewed by technicians in all parts of the world, and discussed at conferences of technicians from European and American countries and from countries concerned with statistical programmes in less-developed areas.

The entire ' Report on the 1950 World Census of Agriculture ' will deal with three different aspects of the census. The census results by countries is published in one volume; a second volume will include a methodological study of the various national censuses, and a third volume will comprise an analysis of the main subjects included in the census.

Methods of Collecting Current Agricultural Statistics, 1955. 15s. It has proved possible to establish a standard pattern for the classification of methods which was found acceptable by most countries and which enables broad comparisons to be made. It is hoped that the present loose-leaf handbook incorporating the information assembled according to this pattern will go some way towards meeting the need for a comparative understanding of the methods used in different countries. In particular it is hoped that this study will assist countries to view their own statistical systems in a wider perspective and make apparent possibilities for improvement.

FARM MACHINERY

Farm Equipment at the B.I.F.

Agricultural products are not normally catered for at the British Industries Fair, but each year more equipment used in industry becomes applicable to farming.

Trench Excavator

Thus the dump trucks exhibited by Whitlock Bros. Ltd., which are designed primarily for construction work, can be applied for muck clearing and allied jobs in sheds and yards. The same firm also exhibited the ' Dinkum Digger ' trench excavator, which is suitable for attachment to crawler tractors. The trench excavator is designed to excavate trenches to a depth of more than 9 ft. and up to 36 in. in width.

Hydraulic Platform

The Simon ' Hydraulic Platform ', manufactured by Simon Hydraulic Machinery, Dudley, Northumberland, is a machine with many applications for agriculturists and horticulturists.

It is mobile, easily controlled and extraordinarily flexible in range of movement, for it can put a man—or two men if required—into almost any place where men can work aloft, up to 40 ft. or more.

Operation is entirely hydraulic and pressure is provided by a pump driven by a small internal-combustion engine; most of the main working parts are self-lubricating.

All movements are controlled from the platform by means of pedals for raising and lowering and a knee-operated rotation control, leaving the operator's hands free for his work. Duplicate controls are provided on the turntable. Spring lock-outs are fitted to prevent movement of the vehicle while the platform is in use. Strong outrigger jacks are also fitted at the rear and sides. The turntable is self-locking for safety when the vehicle stands on a gradient. Maximum horizontal extension is 23 ft. from the centre of the turntable and the turntable can rotate continuously in either direction.

The Simon hydraulic platform. All hydraulic lines are of stainless-steel tubing. Should the pump or motor fail the platform stays in position until lowered by the operator. Automatic cut-outs stop motion if platform moves beyond set limits or descends on a solid obstruction

Rotary Cultivator

Clifford Aero and Auto Ltd., Birmingham, were showing their latest type of rotary cultivator. This is the Mark I, which, in many respects, is a scaled-down version of their Mark IV model. The Mark I rotary cultivator has many unique features. The all-geared transmission is completely enclosed in a compact gear box. Besides the reduction gearing, the box contains a multi-plate clutch running in oil, the reduction drive and worm wheel to the land wheels. A torsion shaft, mounted on ball and plain bearings, enables power to be transmitted for driving the robust 12-in. tiller (fitted with rigid hoe blades or spring tines) at either end of the box. Thus the Mark I has dual direct p.t.-o. points for driving a variety of attachments without the use of the customary belt drives and pulleys. The two-stroke power units offered are a 70-c.c. Villiers or an 80-c.c. JAP engine, each of which develops 1.2 h.p. at 3,000 r.p.m. A more powerful version producing 2 h.p. is available in the form of a 147-c.c. Villiers engine. An efficient oil-bath air cleaner is supplied with all engines. A full range of attachments will be available, namely, a 30-in. cutter bar, a 12-volt electric generator, a hoeing frame, a light plough and a tiller ridger.

Telescopic Lifter

A new-type telescopic lifter was shown by Industrial Machine and Equipment Co. (Brimpex) Ltd. It works on the same principle as the standard machines, *i.e.* no operator is required once it has been wheeled to location and the electric motor or petrol engine has been started. From then on the actual load operates the machine. The capacity is 2-2½ cwt. and the load can be lifted to maximum,

9 ft. 2 in. from floor level. Collapsed, this machine is of approximately the same height as the standard ' Brimpex ' machines, *i.e.* 6 ft. 10 in.

As the total weight of the machine is heavier than the standard machines, a special device has been incorporated whereby one man can easily, by pulling a handle, lift the front of the machine off the floor on to castors. It can then be easily manoeuvred through narrow passages by one man. The device incorporates the following additional safety features:

(1) The lifting movement cannot be engaged as long as the machine is raised on to its castors.

(2) The machine cannot be raised on to its castors as long as it is handling a load.

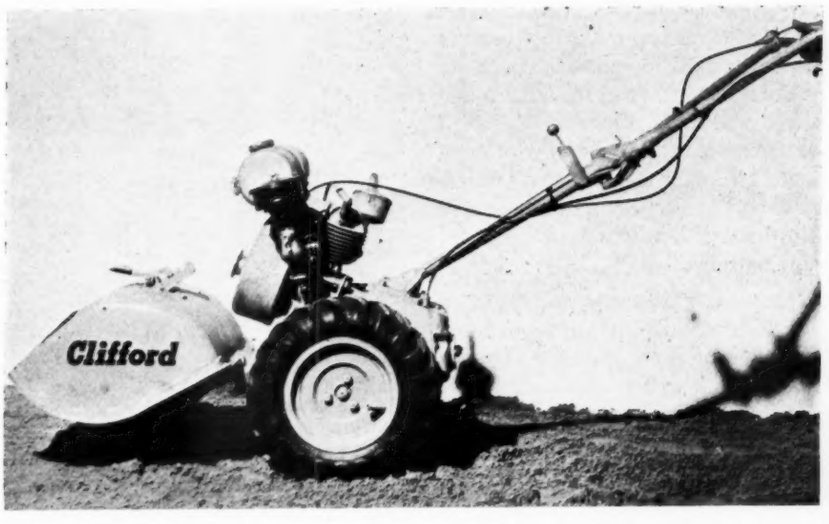
Drill Hammer

The Rawlplug drill hammer was shown by Rawlplug Co. Ltd., London. As its name implies, it is an attachment which, when fitted to an electric drill, converts its rotary motion to a percussive action, each revolution producing a blow. Any type of electric drill which has a working speed of up to 2,000 r.p.m. and a minimum $\frac{1}{4}$-in. chuck can be used. The best operating speed is between 1,500 and 2,000 r.p.m. An automatic clutch is provided, which ensures that the striking mechanism does not come into operation until the tool is pressed against the masonry and it ceases to operate immediately this pressure is released. In hard, well-seasoned concrete it will produce a No. 12 ($\frac{1}{4}$-in.-diameter) hole 2 in. deep in 90 seconds when used in a drill running at 2,000 r.p.m. Its capacity ranges from No. 3 holes to No. 20 (*i.e.* $\frac{1}{8}$-in. to $\frac{3}{8}$-in. diameter) and an adjustment is provided so that the strength of the blow can be regulated to ' light ', ' medium ' or ' heavy ' as required.

Grease Gun

The new ' Nubrex ' high-pressure side-lever grease gun was also on display. It is manufactured by Ch. J. Neumann Ltd., Surrey. It was specially designed for use with tractors and is a smaller, scaled-down model of their larger one used by garages, agricultural engineers and tractor manufacturers. Of very sturdy construction, yet extremely light in weight (3 lb.), this new grease gun has a Meehanite head, very close grain, a precision ground piston and a capacity of $\frac{3}{4}$ lb. Working on the lever principle, this gun exerts a pressure of 10,000 lb./sq. in.

A tracklayer model of the ' Dinkum Digger ' attached to a County crawler tractor excavating a trench and loading direct into the 4½-cu.-yd. dump wagon



The Clifford Mark 1 rotary cultivator. The machine has two forward speeds and the overall weight, including tiller, is 170 lb.

Crown Pump

The Crown gear-type A self-priming water pump was also shown at the B.I.F. It is manufactured by the Crown Engineering Co., Middlesex, and consists essentially of the body and front and back covers, which are machined from high-quality gun-metal castings, paper gaskets sealing the joints between body and covers. These units house and locate the stainless-steel shafts, brass gears, gland packing and the spring-loaded relief valve, which is incorporated to alleviate the normal wear occasioned by ' back-pressure .

The pump is designed for use where high or low pressures are required and it is ideally used with water, insecticides and certain chemicals. One of the most popular uses of this pump is for the spraying of crops and orchards, as it is easily coupled to the p.t.-o. shaft of all tractors.

The 'Farmers' Boy'

A demonstration was held recently by the Raven Engineering Co. Ltd. to demonstrate their new tractor, the 'Farmer's Boy' Major. This tractor incorporates many new features and has been designed in accordance with the recorded opinions of agents in Britain and overseas.

The tractor was seen at work on a number of tasks. It ploughed fairly heavy soil to a depth of 6 in. at walking pace. Its ease of handling was amply proved by a 10-year-old child taking over its control. The machine was then demonstrated doing a variety of jobs, *e.g.* hoeing, cutting and mowing. It has two speeds which can be changed in a matter of seconds.

The power of the tractor was amply demonstrated; it hauled a trailer and seven men up a fairly steep incline with ease.

Oversea agents are adapting this machine to many uses. In Australia it is being used to generate electricity for domestic and farm machinery and to dig post holes. In Scandinavia it has been fitted with a rotary brush and 'dozer blade for snow-clearing operations, and in Southern Rhodesia it is being used with a fitted 12-ft. boom for spraying tobacco.

Engines. The power units chosen for this machine are the 148-c.c. Villiers Mark 15 and the 256-c.c. Villiers Mark 25 four-stroke air-cooled petrol engines. The units are quickly interchangeable and are located on adjustable brackets held in position with two set bolts and a hardened steel pin. By the removal of the hardened steel pin the engine hinges backwards to allow the heavy-duty V-drive belt to be changed to either low or high speed.

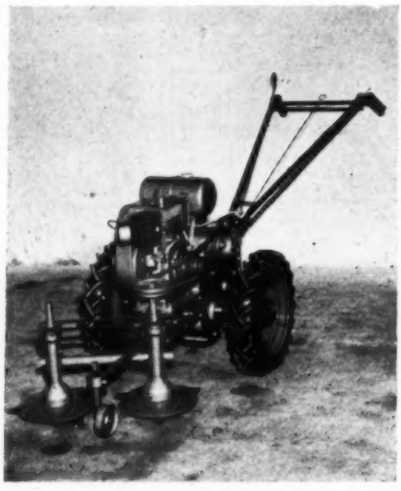
The alternative engine units are available to cover the requirements of the small garden user or the larger estate and market gardener.

Transmission. The transmission has been designed to cover h.p. ranging from $1\frac{3}{4}$ to 4 through a series of heavy-duty chains and dog clutch to a hollow hexagonal final drive which takes the interchangeable hexagonal axles. These axles vary from 15 in. to 36 in. in length, are fully adjustable to suit any set-up and are positioned with one set bolt. The final drive bearings are of large diameter and are fitted with oil seals, the whole internal drive being in an oil-bath.

Handlebars. These are adjustable from a finger-tip control to swing left or right, and another lever, spring-loaded, allows for height adjustment. Both engine and clutch finger-tip controls are mounted on the handlebar.

Tool-bar bracket. Provision has been made for simple front or rear mounting of equipment by means of two special quickly fitted set bolts, dispensing with the usual spanner and, when in position, they are locked with the self-locking tommy bar.

Free-wheels. The wheel hubs are fitted with adjustable spring-loaded pawls as standard equipment and have been so designed as to give the operator the choice of fixed, forward or reverse free-wheel, or complete no-drive transmission to either or both wheels.



Rotary scythe. Twin scythes with cutting width of 30 in. Fully adjustable V-belt drive and single wheel-height adjustment

Cutter bar. The cutter bar is mounted direct as an assembly to the front tool-bar bracket, using the two simple-fitting tool-bar set bolts. The drive for the cutter bar is taken by a connecting rod from the crank disc on the rear p.t.-o. extension shaft by a detachable crank pin. Low speed is used.

Tool bar. The tool bar can be mounted either at the front or rear of the tractor and made up to the operator's requirements with a series of square-section bars and clamps.

3-Ton Tipping Tractor Trailer

Exhibited for the first time recently, the new Series 100 Salopian 3-ton tipping tractor trailer aroused considerable interest because of its many outstanding advantages. The chief of these is undoubtedly its exceptionally robust construction throughout, characterised by its strong welded pressed-steel chassis, body pivot points of very solid design and fitted with grease nipples, the thickness and type of hardwood used in the manufacture of the body, and the side and end boards which can be dropped or removed.

A two-wheeled 3-ton end hydraulic tipping model, it has a 10-ft. × 6-ft. hardwood timber platform, fitted with 15-in. detachable side and end boards. The overall length is 14 ft., overall width 6 ft. 4 in., normal track 4 ft. 8 in., and loading height 2 ft. 10 in. The tyre equipment comprises 7.50 × 16 eight-ply covers, wheels fitted with taper roller bearing hubs and 12-in. internal expanding brakes. A ring-type hitch or standard jaw coupling can be supplied to suit most makes of tractor, and a screw jack can be supplied as an alternative to the shoe.

Wolseley Engineering Ltd.

The Wolseley Sheep Shearing Machine Co. Ltd. has recently changed its name to Wolseley Engineering Ltd. The reason for this change is that the nature of the company's business has altered very considerably since its incorporation over 60 years ago.

Technical News

Dairy Engineering for July features milk containers and includes articles on 'Outlook for Milk Bottles', 'Swedish Progress with Milk Cartons' and 'British Milk Carton Filling and Sealing Equipment'.

The July issue of *Manufacturing Chemist* contains a progress report on fertilisers by D. P. Hopkins.

The contents of *Food Manufacture* for July include 'Deep-freezing by the Protan Method' by Dr. Ing. Alf Olsen.

Fibres (Natural & Synthetic) for July includes 'Industrial Uses of Artificial Fibres—1' by R. W. Moncrieff, B.SC., F.R.I.C., F.T.I.

WORLD CROP REPORTS

INTERNATIONAL

Soya beans. World production of soya beans established a new record in 1954. According to the second estimate of the Foreign Agricultural Service, 742.8 million bushels were harvested, representing a 14% increase from the 1953 revised estimate of 651 million bushels and a 10% increase from the previous high of 675 million bushels produced in 1952. The second estimate of production in 1954 is 8 million bushels larger than the preliminary forecast.

Over 80% of the total increase from 1953 of almost 92 million bushels is accounted for by the U.S.A. Most of the remainder is due to the expansion that is reported to have occurred in China-Manchuria. Sizable increases are also reported for virtually all of the secondary producing areas for which reliable data are available, with the exception of Japan.

Soya-bean production in the *United States* at 342,795,000 bushels was the highest on record, exceeding the 1953 crop by 28% and the previous high of 299 million bushels in 1950 by 15%. Of the record 19.3 million acres planted, about 17 million acres or 88% was harvested for beans. The yield per acre of 20.1 bushels was well above the relatively low yield of 18.3 bushels in 1953, but only slightly above the 1943-52 average of 19.9 bushels. Acreage expansion is explained by the diversion of land from other crops, such as corn, wheat and cotton, which were under acreage allotment, and favourable prices for soya beans during and previous to planting time.

Just over 5 million bushels of soya beans, a new record, were harvested in *Canada* in 1954. The 15% increase from 1953 was due entirely to the 18% acreage expansion, as yields per acre fell below the 20-bushel level for the first time since 1948. Because of the late season and poor harvesting conditions, some downward revision of the production estimate as of last November reportedly may yet be made. Commercial production of soya beans in Canada is confined to Ontario Province.

Soya-bean production in *China-Manchuria* is believed to have shown some increase in 1954, based on the limited information available. A harvest in the neighbourhood of 350 million bushels would appear to be a reasonable estimate.

In *Japan* acreage in soya beans increased slightly in 1954, but unfavourable weather reduced the yields and the final out-turn reached only 13.8 million bushels, compared with 15.8 millions the previous year. Output in *Taiwan* increased 10% and in *Turkey* 18%. *Thailand's* crop probably approximated the 1953 level.

Brazil's harvest at 3.5 million bushels was up 13% from the year before. Some 2.6 million bushels were expected to be available for either crushing or export. The much publicised programme to increase soya-bean planting in São Paulo has so far met with discouraging results. This reportedly is due to farmers' dissatisfaction with earnings derived from soya beans compared with cotton and some other crops and to a shortage in São Paulo of combine harvesters. The Government, however, continues to try to interest large-scale farmers in growing soya beans.

Production in Africa is relatively insignificant. *Nigeria*, with production for export of about 140,000 to 150,000 bushels, appears to be the major producer.

A still larger world crop of soya beans is in prospect in 1955. With the continuation of restrictions on corn, wheat and cotton in the U.S.A., acreage in soya beans probably will be at least as large as last year's and average growing conditions could result in a new record high output. Increased production probably will be encouraged in China-Manchuria in an effort to attain self-sufficiency in vegetable oils, now in short supply, and to allow a greater quantity for export.

Foreign Crops and Markets.

Cocoa. In the January report the 1954-55 world cocoa crop was estimated to range between 1,748 million lb. and 1,770 million lb., which would have meant a 10 to 12% rise over the 1953-54 crop. The estimate is now reduced to a range of 1,705 million lb. to 1,713 million lb., due to revision in the Nigerian crop, based on crop purchases now practically completed. The revised 1954-55 world crop figure represents an increase of 8.1 to 8.6% over 1953-54.

DENMARK

Grain crops. Assuming a normal crop yield in 1955, Denmark will be short of about 45,000 tons of wheat and 15,000 tons of rye to meet domestic requirements as a result of a considerable reduction in the areas under bread-grains.

In the autumn of 1954, 66,000 hectares were sown to wheat and 75,000 to rye. With the addition of spring-sown crops, these areas should total 70,000 and 75,000 hectares respectively. With a normal crop yield, these areas are estimated to produce a total crop of 270,000 tons of wheat and 200,000 tons of rye, against 279,000 and 280,000 tons in 1954. Domestic requirements are put at about 315,000 tons of wheat and about 215,000 tons of rye.

ANGOLA

Sisal production. Sisal production in Angola (Portuguese West Africa) decreased in 1954 by about 9.1% compared with the preceding crop, as reported by Foreign Service Officers in Luanda, Angola. Exports of sisal were reported at approximately 61.2 million lb. in 1954, compared with the peak of 67.4 millions in 1953 and a pre-war average of 11.3 million lb. Exports had increased each year since 1928 except in several years during the war period, and thus presented a steady upward trend.

France was the most important destination for Angolan sisal in the past year with about 31.3% of the total quantity and 31.5% of the total value. The U.S.A., Germany and Portugal ranked next in importance. The U.S.A. furnished the chief market for sisal waste with 700,000 lb. from the total of less than 800,000 lb. Waste accounted for less than 1.3% of total sisal exports.

The decline in production and exports in 1954 resulted from the weakening in world demand and prices which

began early in 1952 and has continued into 1955. The lack of strong foreign demand, combined with the lower price level, has presented serious problems to the industry. It is reported that current prices are about on a level with production costs, and producers are even encountering difficulty in finding markets at the current prices.

The average annual f.o.b. price was estimated at about 8.6 cents per lb. in 1954, compared with the 1951 peak of 23.4 and the 1939 price of 2.8 cents.

NEW ZEALAND

Apple and pear crops. The 1955 New Zealand apple crop is estimated at 2.7 million bushels, compared with 2.9 millions last season. The Apple and Pear Marketing Board is planning to export 750,000 boxes of apples this spring and summer, compared with 1,250,000 boxes last season. Most of the exports will be consigned to the United Kingdom with small shipments to Germany, France and Canada.

The Marketing Board has set aside 200,000 boxes of apples for the dehydration factory in an effort to increase the dried apple pack for 1955.

The pear crop is estimated at 400,000 bushels, which is larger than the small crop of 360,000 bushels last season. All of the pears will be needed for domestic consumption and no exports are planned.

CHILE

Onions. The acreage of onions in Chile increased 6% over 1954. Official estimates of production are not available, but trade sources indicate a production of 4 to 4.4 million 50-lb. sacks.

An export quota of 660,000 sacks has been fixed, but trade sources report that the quota could be increased to 1,100,000 sacks without affecting domestic requirements.

Foreign Crops and Markets.

SUDAN

Cotton. Picking, on the whole, is coming to an end in many main centres of the Sakel areas.

Sudan Gezira Board. Picking fell off sharply towards the end of the month. The sharp reduction was due to the lack of January flowering and heavy leaf-fall. Yield estimates in some centres have been very wide of the mark, due to the difficulty in estimating blackarm and leaf-curl damage. However, with about 4.00 k.p.f. picked to date, there is little left to pick on the Sakel blocks. X1730A cotton is expected to pick another $\frac{1}{3}$ k.p.f.

Gash. Pickings were heavy on the first rotation. The difficulty of labour was overcome. There remains little to pick. As for the second rotation, a fairly good amount of cotton is still expected; green foliage and flowers are observed.

Tokar. General prospect of the crop is rather poor, due to the combined effect of cloud and winds, and the high humidity during February and March. These unfavourable climatic conditions have depressed the yield from 60,000 small kantars to about 45,000 small kantars through aphis infestation, shedding of leaves, flowers and bolls. The auction sale of cotton is proceeding satisfactorily.

Nuba Mountains. Picking is in full swing in many main centres with the exception of few in which picking is already completed.

Dura. On Government pilot mechanised farms in Gedaref District threshing was in full swing at Um Sugura and Camp 8. Feterita yields are estimated at 700 to 1,000 lb. per feddan and Mugud yields at 1,000 to 1,200 lb. per feddan. In the Gedaref District the harvest of late-sown dura has been completed. Average yield per feddan was 832 lb. The total crop marketed during the month at Gedaref crop auction centre reached 4,408 tons.

ENGLAND AND WALES

Agricultural report. Agricultural conditions in England and Wales on May 1, 1955, have been summarised by the Ministry of Agriculture. Very good progress was made with cultivations and sowing. The growth of corn crops was retarded by cold and dry weather, but they improved in the latter half of April. Pastures made little growth until the end of the month.

Weather conditions. The weather during the first week of April was changeable with rain and sunny periods. Fine dry weather, but with cold winds, then followed and lasted until the last few days of the month, when changeable weather returned, bringing some rain to most districts. Night frosts were frequent.

Spring sowing. Very good progress was made with the sowing of corn and much of the time lost owing to bad weather has been made up. Seed beds were good except on some late-ploughed heavier soils which have not worked well.

Corn crops. Reports from most areas indicate that cold winds and night frosts and, in several districts, the absence of rain have retarded growth. Crops improved in the latter half of April, but generally they were not as forward as usual.

Winter wheat is generally satisfactory; damage by frost and earlier waterlogging is reported from several areas. Spring wheat has germinated well.

Winter barley suffered some frost damage and some patching has been necessary, but otherwise crops are satisfactory. Spring barley: earlier sowings have germinated well and are generally healthy.

Winter oats were adversely affected by frosts and cold winds in several areas, but, on the whole, crops are generally healthy. Spring oats germinated satisfactorily and where through they look well.

Mixed corn and rye are generally satisfactory.

Potatoes. Conditions for planting potatoes were favourable and, except in some heavy soil areas, land worked well. Good progress was made with planting during the month, but owing to the lateness of the season this work generally is not so forward as usual.

Roots. Conditions were favourable for the preparation of land for sowing root crops and, although some of the heavier soils were difficult to work, good progress was made in most areas. Good progress was made with the drilling of sugar-beet and other root crops, but generally work is rather less forward than usual.

Pastures. Leys are generally healthy, but backward for the time of year. Cold nights and lack of moisture retarded growth, but there was some improvement towards the end of the month.

Permanent pastures also made little growth until the end of the month and they have provided less keep than usual.